TC- 6168

SUMMARY OF TEST REPORT No. 4789949365-BIS-S2, DATED(mm/dd/yyyy): 10/28/2021
ULR No. TC616821100000893F
(Number of pages in test report: Page no.1 to 66)
TEST FORMAT AS PER IS/IEC 61730-1:2004 + A1:2017+A2:2017

1. Name of manufacturer:	Visaka Industries Limited (Atum Division)
2. Product:	Crystalline Silicon Photovoltaic (PV) Modules
3. Model:	72 Full Cell Mono crystalline models **Representative Model: VIL-375M** Series Model: VIL-370M
4. Model differences provided (if applicable): Yes/No	YES
5. Model differences verified as per MNRE Guidelines for series formulation: Yes/No	YES
6. Test Results:	

SL. NO.	TEST REQUIREMENTS	CLAUSE	VERDICT
1	Application Classes	3	**P**
2	Construction Requirements	4	**P**
3	Polymeric Materials	5	**P**
4	Internal Wiring and current-carrying Parts	6	**P**
5	Connections	7	**P**
6	Bonding and Grounding	8	**P**
7	Creepage and clearance distances	9	**P**
8	Field Wiring compartments with covers	10	**P**
9	Marking	11	**P**
10	Requirements for supplied documents	12	**P**

General Information:

1. The conformity certificates of critical components are verified to ensure complete testing of Product under test and details regarding harmonized IEC/UL Standards (where IS standards are not available) are also provided in the list of critical components.

CONCLUSION:

1. Sample meets all relevant requirements of IS/IEC 61730-1:2004 + A1:2017+A2:2017: Yes

~~2. Sample fails to meet the following test requirements:~~

I, hereby, undertake that the verdict stated in the test reports for all the tests matches with the test results. The sample meets all relevant requirements of IS/IEC 61730-1:2004 + A1:2017+A2:2017~~./does not meet the requirements stated above at 2) of conclusion~~. If any deviation is found, suitable punitive action may be taken by BIS

Srimathy N
Digitally signed by Srimathy N
Date: 2021.10.28 18:58:59 +05'30'

Date(mm/dd/yyyy): 10/28/2021 **(Signature of Authorized person)**

UL India Private Limited
Registered Office: Kalyani Platina - Block I, 3rd Floor
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CIN: U74200KA1997PTC023189

TC- 6168

Test Report issued under the responsibility of:

TEST REPORT
IS/IEC 61730-1
PV Module Safety Qualification
Part 1: Requirements for construction

Report Number. .....:	**4789949365-BIS-S2**
ULR. Number.....:	TC616821100000893F
Test Request.....:	SC21SPI00508
Date of issue(mm/dd/yyyy).....:	10/28/2021
Total number of pages.....:	66
Applicant's name.....:	VISAKA INDUSTRIES LIMITED (ATUM DIVISION)
Address .....:	Survey No 95 & 96, Adjacent to Kukkadam Railway Station, Kukkadam Post, Gajalapur, Madugulapally, Nalgonda-508207, Telangana, India.
Test specification:	
Standard .....:	IS/IEC 61730-1:2004 + A1:2017+A2:2017
Test procedure .....:	IS/IEC 61730-1:2004 + A1:2017+A2:2017
Non-standard test method.....:	N/A
Test Report Form No.....:	IS/IEC 61730-1_V1.0
Test Report Form(s) Originator.....:	BIS
Master TRF .....:	Dated 19.02.2018

IS/IEC 61730-1:2004 (First Edition) + A1:2017+A2:2017			
Clause	Requirement + Test	Result - Remark	Verdict

Test item description .....:	Photovoltaic (PV) Module(s)
Trade Mark .....:	ATUM by VISAKA
Manufacturer.....:	VISAKA INDUSTRIES LIMITED (ATUM DIVISION)
Address .....:	Survey No 95 & 96, Adjacent to Kukkadam Railway Station, Kukkadam Post, Gajalapur, Madugulapally, Nalgonda-508207, Telangana, India.
Model/Type reference .....:	Representative Model: **VIL-375M** Series Model: VIL-370M
Ratings .....:	Maximum System Voltage: 1500V Maximum over current protection rating: 14A See specific model rating in General Product information

IS/IEC 61730-1:2004 (First Edition) + A1:2017+A2:2017			
Clause	Requirement + Test	Result - Remark	Verdict

Testing procedure and testing location:		
☒ **Testing Laboratory:**		
Testing location/address……:	UL INDIA PVT. LTD. LABORATORY BUILDING, KALYANI PLATINA CAMPUS, SURVEY. NO. 129/4, EPIP ZONE, PHASE II, WHITEFIELD, IN-560066, BANGALORE, INDIA	
Tested by (name + signature) ……:	Viswanathan K	K. Viswanathan Digitally signed by K. Viswanathan Date: 2021.10.28 18:24:37 +05'30'
Approved by (name + signature) ……:	N Srimathy	Srimathy N Digitally signed by Srimathy N Date: 2021.10.28 18:59:40 +05'30'
Issued by (name + signature) ……...:	Kantha Raju H S	Kantha Raju Digitally signed by Kantha Raju Date: 2021.10.28 19:06:59 +05'30'

IS/IEC 61730-1:2004 (First Edition) + A1:2017+A2:2017			
Clause	Requirement + Test	Result - Remark	Verdict

List of Attachments (including a total number of pages in each attachment):

Annex 1: Construction Details – 2 Pages (28-29)

Annex 2: List of measurement Equipment page – 1 Pages (30)

Annex 3: Enclosures Page (Reports/Certificates and manual) – 35 Pages (31-65)

Annex 4 : Electrical data of PV modules page – 1 Pages (66)

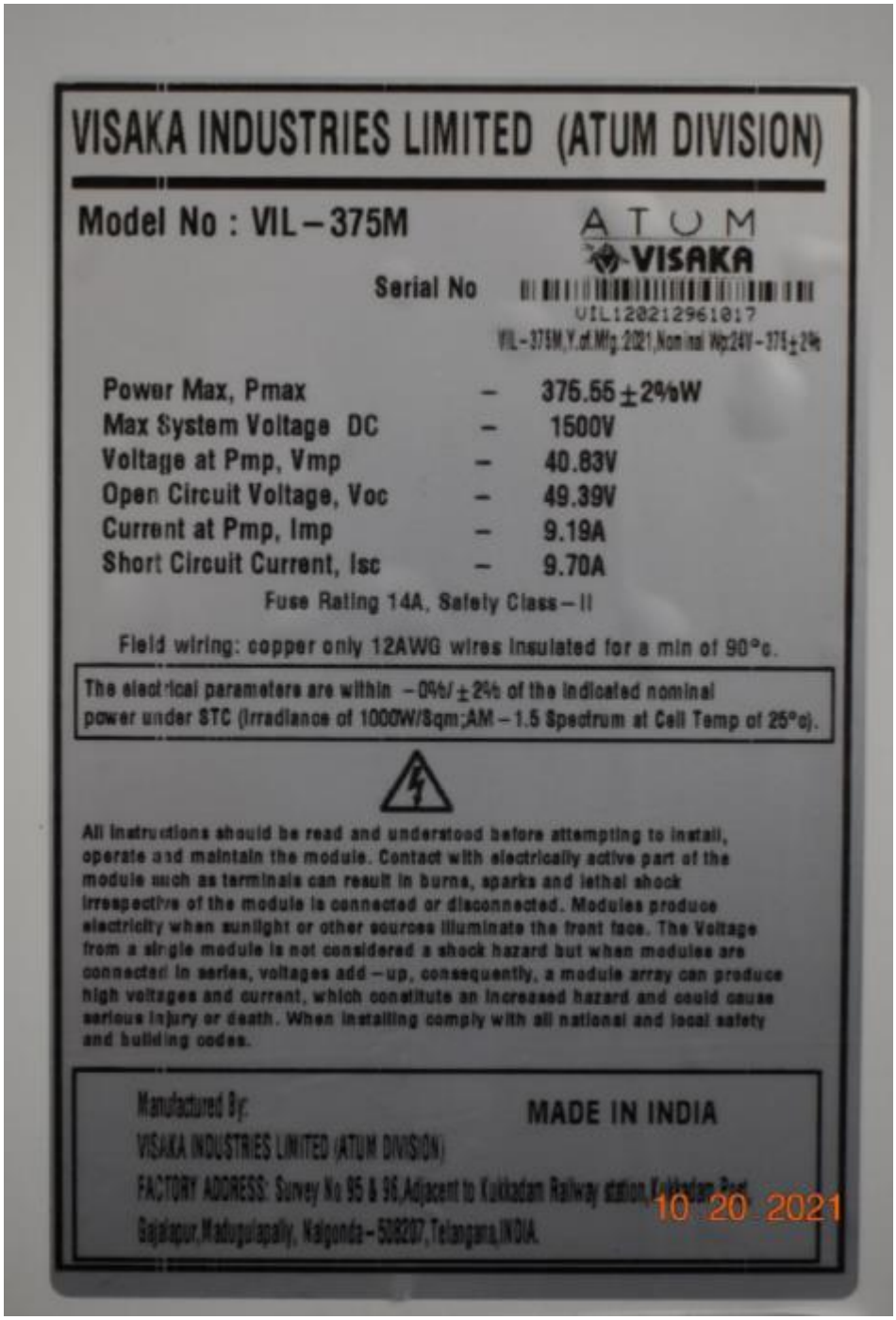
Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
Model VIL-375M from Mono cell families were considered as representative of all series with same component All models are same in construction except output power and electrical ratings.	UL INDIA PVT. LTD. LABORATORY BUILDING, KALYANI PLATINA CAMPUS, SURVEY. NO. 129/4, EPIP ZONE, PHASE II, WHITEFIELD, IN-560066, BANGALORE, INDIA
3. Application Classes	
4. Construction Requirements	
5. Polymeric Materials	
6. Internal Wiring and current-carrying Parts	
7. Connections	
8. Bonding and Grounding	
9. Creepage and clearance distances	
10.Field Wiring compartments with covers	
11. Marking	
12. Requirements for supplied documents	

☒ **The product fulfils the requirements of __ IS/IEC 61730-1:2004 (First Edition) + A1:2017 + A2:2017 (insert standard number and edition and delete the text in parenthesis, leave it blank or delete the whole sentence, if not applicable)**

Copy of marking plate:

Back label for Representative Model: VIL-375M



Note: Photo Date format (mm/dd/yyyy)

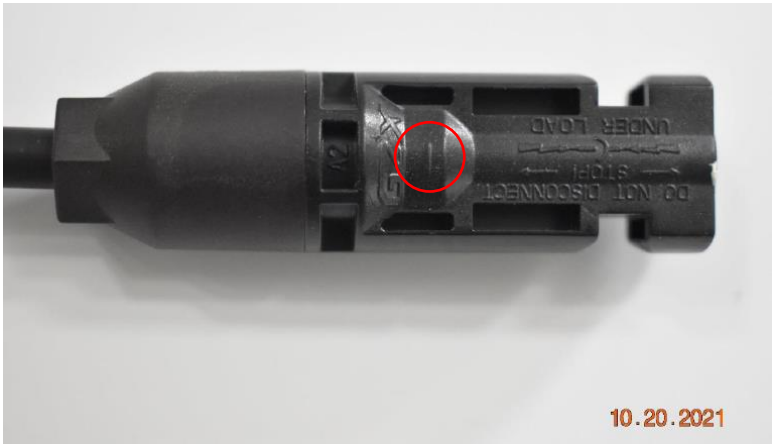
Inside laminate Marking label

Inside laminate marking label with serial No. "VIL120212961017".
as declared by the manufacturer, 5th to 8th digits from left "2021" representing manufactured Year, 9th and 10th digit from left "29" representing manufactured week of the year, 11th digit "6" represents the day of the week (That is Saturday).

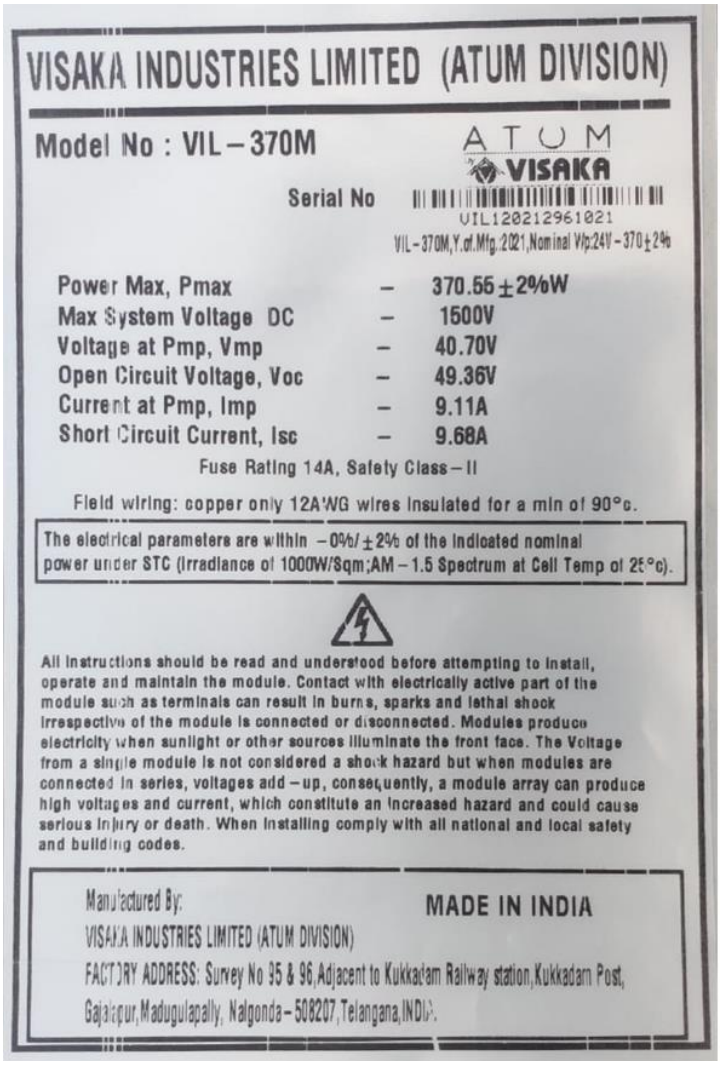
Note: Photo Date format (mm/dd/yyyy)

Junction Box and connectors with polarity marked

Connectors with polarity marked



Series Model Back Labels :

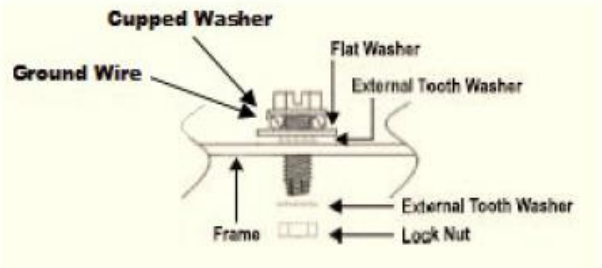
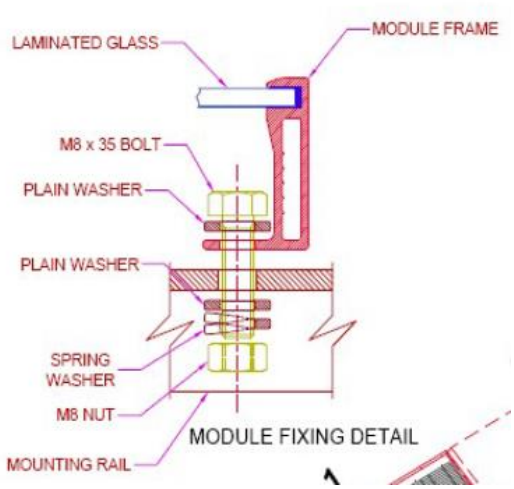


Inside Laminate of model series:

Logo of Make in India:

Logo is common for all the models

The marking plate above represents all models covered by this report except for difference in electrical ratings and model designation. See “General product information” for electrical ratings for all models

Test item particulars:	
Accessories and detachable parts included in the evaluation……..:	**Grounding the Array:** Attach a separate conductor to one of the 4mm diameter grounding holes marked on the Module frame with a screw and nut that incorporates an external tooth washer. This is to ensure positive electrical contact with the frame. It is recommended to ground each module frame at the provided grounding holes (4 mm or 5/32-inch diameter, marked with the grounding symbol). The modules can be connected at the grounding holes using stainless steel nut, bolt, start washer and flat washer of size M4  The grounding screw, bolt or other parts are separately used from the mounting parts of the module. The grounding is achieved through securement to the array frame. The torque rating provided for grounding means is 2.8 Nm [25 in.–lbs].
Mounting system used……..:	**Mounting Method:** The frame of each Module has 8mm x 12mm mounting holes used to secure the modules to supporting structure. The Module frame must be attached to a supporting structure using M8 stainless steel bolt hardware together with hex nut, spring washers and 2nos of plain washers in four places (i.e. minimum number holes to be used are 4 mounting holes) symmetrical on the SPV Module. The applied torque is about 8 Newton-meters. 
Other options included:	N/A

Possible test case verdicts:	
- test case does not apply to the test object... :	N/A
- test object does meet the requirement ..... :	P (Pass)
- test object does not meet the requirement .. :	F (Fail)

Abbreviations used in the report:

Pmax	– Maximum power	PD	– Partial Discharge
Vpm	– Maximum power voltage	RTI/RTE	– Relative Thermal Endurance Index
Ipm	– Maximum power current	STC	– Standard Test Conditions
Isc	– Short circuit current	TC	– Thermal Cycling
Voc	– Open circuit voltage	CTI	– Comparative Tracking Index
FF	– Fill factor	MST	– Module Safety Test

Testing ..... :	Refer individual test date
Date of receipt of test item(mm/dd/yyy) ..... :	07/03/2021
Date (s) of performance of tests(mm/dd/yyyy):	10/20/2021

General remarks:

"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.

Throughout this report a ☐ comma / ☒ point is used as the decimal separator.

This Test Report Form is intended for the investigation of PV modules in accordance with IS/IEC 61730-1. It can only be used together with IS/IEC 61730-2 Test Report.

Name and address of factory (ies)..... :	VISAKA INDUSTRIES LIMITED (ATUM DIVISION) Survey No 95 & 96, Adjacent to Kukkadam Railway Station, Kukkadam Post, Gajalapur, Madugulapally, Nalgonda-508207, Telangana, India.

General product information:	All models are same in construction output power and electrical ratings System Voltage: 1500V
PV module type reference .....:	**VIL-375M (Representative Model)**
Product Electrical Ratings at STC	
Nominal maximum power (Pmax) .....:	375.55 W
Nominal open circuit voltage at (Voc) .....:	49.39 V
Nominal short circuit current at (Isc) .....:	9.70 A
Nominal maximum power voltage (Vpm) .....:	40.83 V
Nominal maximum power current (Ipm) .....:	9.19 A
Product Safety Ratings	
Maximum systems operating voltage .....:	1500 V
Maximum over-current protection rating.....:	14 A
Safety application class .....:	Class A
Safety class in accordance with IEC 61140 .....:	Class II
Fire safety class .....:	Class C
Recommended maximum series/parallel module configurations .....:	24 modules in series for 72 cell Model series Note: Refer Annex 4 for all electrical ratings of all series model

Scope of Module Safety Qualification Testing:

☒ Initial module safety qualification

☐ Extension of module safety qualification

Original test report ref. no. ..... :

Model differences and modification:

☐ Change in cell technology	☐ Change in cell interconnect materials/technique
☐ Modification to encapsulation system	☐ Modification to junction box/el. termination
☐ Modification to superstrate	☐ Change in el. circuit of an identical package
☐ Modification to backsheet/substrate	☐ Higher or lower output by 10 %
☐ Modification to frame/mounting structure	☐ Increase in module size
☐ Removal of frame	

Note (1) Use the “General product information” field to give any information on model differences within a product type family covered by the test report.

Note (2) Use the “General product information” field to describe the range of electrical and safety ratings, if the TRF covers a type family of modules.

Note (3) Use Annex 1 to list the used materials and components of the module (manufacturer/supplier and type reference)

IS/IEC 61730-1:2004 (First Edition) + A1:2017+A2:2017			
Clause	Requirement + Test	Result - Remark	Verdict
3	**Application Classes**		**P**
	The module has been evaluated for the following Application Class (Class A, B, C) ..... :	Class A	P
4	**Construction Requirements**		**P**
4.1	**General requirements**		
4.1.1	It is stated that the module is able to operate under environmental condition type AB8 according to IEC 60364-5-51.	Air temperature: -40°C to 85°C Rel. Humidity: < 85% RH	P
4.1.2	The module/s is/are completely assembled when shipped from the factory.		P
	The module is provided in subassemblies.		N/A
4.1.3	Incorporation of a module into the final assembly does not require any alteration of the module from its originally evaluated form. If YES, specific details describing necessary modification(s) are provided in the installation instructions.	No modification required	P
4.1.4	If the module must bear a definite relationship to another module, it is constructed to permit incorporation into the final assembly without the need for alteration.	-	N/A
4.1.5	The construction of the module is such that ground continuity is not interrupted by installation.	-	N/A
4.1.6	Parts of the module are prevented from loosening or turning, if such loosening or turning may result in a risk of fire, electric shock, or injury to persons.	JB is secured by adhesive material to back skin	P
4.1.7	Friction between surfaces is not used as the sole means to inhibit the turning or loosening of a part.	-	P
4.1.8	Any adjustable or movable structural part is provided with a locking device to reduce the likelihood of unintentional movement.	-	N/A
4.2	**Metal parts**		----
4.2.1	Metals used in locations that are exposed to moisture shall not be employed alone or in combinations that could result in deterioration, such that the product would not comply with the requirements in this standard.	Only Aluminium and stainless steel used	P
4.2.2	Iron or mild steel serving as a necessary part of the module but not exposed to the weather are plated, painted, or enamelled for protection against corrosion.	-	N/A
4.2.3	Simple sheared or cut edges and punched holes are not required to be additionally protected.	-	N/A

IS/IEC 61730-1:2004 (First Edition) + A1:2017+A2:2017			
Clause	Requirement + Test	Result - Remark	Verdict
5	**Polymeric Materials**		**P**
5.1	**General**		
	Polymeric materials serving as an enclosure for live metal parts	See Subclause 5.2	—
	Polymeric materials serving as support for live metal parts	See Subclause 5.3	—
	Polymeric materials serving as the outer surface for the module	See Subclause 5.4	—
	Polymeric materials serving as superstrate or a substrate which provide rigid reinforcement or serve as the carrier for the active cells		—
	a) If the superstrate or substrate polymers are intended for contact with active cells	See Subclause 5.3	—
	b) If the superstrate or substrate polymers are intended for use as an outer surface	See Subclause 5.4	—
	c) If superstrate or substrate polymers are intended for both contact with active cells or other circuit elements and for use as the outer surface	See Subclause 5.3 and 5.4	—
	Polymeric materials serving as barriers	See Subclause 5.5	—
	All polymeric materials have a minimum relative thermal endurance index (electrical and mechanical, as defined by IEC 60216-5) of 20 °C above the maximum measured operating temperature of said material in application, as measured during the Temperature Test MST 21 given in IS/IEC 61730-2.	All materials are at least 20°C above maximum measured temperature. Tested as per temperature test clause MST-21 in IS/IEC 61730-2	P
5.2	**Polymers serving as an enclosure for live parts**		
	Information is provided that polymers serving as an enclosure for live parts comply with:		—
	a) 5-V flammability rating (IEC 60695-11-20)	Junction Box is IEC 62790 certified; certificate is attached in Annex 3	P
	b) 5-V flammability rating, after water immersion and exposure of the end-product (IEC 60695-11-20)	Suitable for outdoor use with respect to exposure to UV and Water Exposure based on UL 746C. Still maintains 5-VA rating.	P
	c) Ultraviolet radiation resistance (ANSI/UL 746C or ISO 4892-2)	Junction Box base and cover material f1 rated in accordance with UL 746C	P

IS/IEC 61730-1:2004 (First Edition) + A1:2017+A2:2017			
Clause	Requirement + Test	Result - Remark	Verdict
	d) Minimum hot wire ignition rating of 30 (IEC 60695-2-20)	Hot wire ignition rating of Junction Box base and cover material is ≥ 120 (In accordance with UL 746C)	P
5.3	**Polymers serving to support live parts**		**---**
	Information is provided that polymers serving to support live parts comply with:		—
	a) Flammability classification and high-current arc ignition rating (IEC 60695-11-10) as given in Table 1 of IS/IEC 61730-1	Junction Box base and cover flammability rating is 5VA, HAI ≥ 120	P
	b) Comparative Tracking Index (CTI) ≥ 250	System Voltage is above 600 V	N/A
	Comparative Tracking Index (IEC 60112) .....:	N/A	—
	c) Inclined plane tracking rating of 1 h, using the time to track method at 2.5 kV (IEC 60587), if the maximum system operating voltage rating is in the range 600 V – 1500 V.	Connectors are certified and certificate are attached in Annex 3	P
	Maximum system operating voltage rating (V):	1500V	—
	d) Ultraviolet radiation resistance (ANSI/UL 746C or ISO 4892-2)	Junction Box base and cover material f1 rated in accordance with UL 746C.	P

5.4	**Polymers serving as an outer surface**		**---**
	Information is provided that polymeric substrates or superstrates used in the module have:		—
5.4.1	A relative thermal endurance index, both electrical and mechanical, as determined in accordance with IEC 60216 of at least 90 °C.....:	Manufactured by: Renewsys India Private Limited, Type: Preserv 1 300 WD, Thickness: 0.395mm, Color: WT, RTI: 140, Flame Spread Index: 30, Partial Discharge: 4.17kV	P
	A relative thermal endurance index of at least 20 °C above the maximum measured operating temperature of the material as measured during the Temperature Test MST21 of IS/IEC 61730-2.	Refer to Temperature Test table MST-21	P
5.4.2	Polymeric materials that serve as the outer enclosure for a module that (1) is intended to be installed in a multi-module or -panel system or (2) have an exposed surface area greater than 1 m² or a single dimension larger than 2 m, has a maximum flame spread index of 100 as determined under ASTM E162-1990.....:	Manufactured by: Renewsys India Private Limited, Type: Preserv 1 300 WD, Thickness: 0.395mm, Color: WT, RTI: 140, Flame Spread Index: 30, Partial Discharge: 4.17kV	P

IS/IEC 61730-1:2004 (First Edition) + A1:2017+A2:2017			
Clause	Requirement + Test	Result - Remark	Verdict
5.4.3	If exposed to direct sunlight in the application, the polymeric material has been evaluated for ultraviolet (UV) radiation resistance as determined in accordance with ANSI/UL 746C or ISO 4892-2.	Manufactured by: Renewsys India Private Limited, Type: Preserv 1 300 WD, Thickness: 0.395mm, Color: WT, RTI: 140, Flame Spread Index: 30, Partial Discharge: 4.17kV	P
5.4.4	Polymeric materials intended for use as a superstrate or substrate, without appropriate IEC insulation pre-qualification, comply with the requirements of the Partial Discharge Test MST 15 of IS/IEC 61730-2.	Manufacturer submitted the Partial Discharge letter from Lab has been verified and attached the Annex 3	P
5.5	**Polymers serving as barriers**		
	Insulation barriers are of adequate thickness and of a material appropriate for the application, as defined by IEC 61140	See Annex 1 for constructional details	N/A
	Barriers or liners are held in place and are not adversely affected	No Barriers/ Liners	N/A
5.6	**Polymers serving as structural glazing materials**		
	Polymers serving as structural glazing materials comply with the requirements for safety glazing by material certification (ANSI Z97.1-93) or by testing in accordance with Module Breakage Test MST 32 of IS/IEC 61730-2.	Refer to Module Breakage test table MST-32 results	P
Supplementary information: N/A			

6	**Internal Wiring And Current-Carrying Parts**		
	Any current-carrying part and wiring has the mechanical strength and current-carrying capacity necessary for its application.	Cell Connectors: Manufactured by: NEOCAB Type: Cross section: 0.9X0.20 mm, Material: Base Cu ⩾ 99.95%, Coating Sn60%Pb40%. String Connectors: Manufactured by: NEOCAB Type: Cross section: 0.3X5.0 mm, Material: Base Cu ⩾ 99.95%, Coating Sn60%Pb40%.	P
6.1	**Internal wiring**		
6.1.1	Wiring used within a module has an insulation rating for a minimum of 90 °C, with a gauge and voltage rating acceptable for the application as defined by the requirements of IEC 60189-2.	See Annex 1 for constructional details	P

IS/IEC 61730-1:2004 (First Edition) + A1:2017+A2:2017			
Clause	Requirement + Test	Result - Remark	Verdict
6.1.2	The wiring of a module is located so that after installation of the module in the intended manner the insulation is not exposed to degrading effects of direct sunlight.	Wire is sunlight resistant	P
6.2	**Splices**		
	Splices are insulated equivalent to that required for the wiring involved.	No Splices	N/A
6.3	**Mechanical securement**		
6.3.1	Joints or connections are mechanically secure and provide electrical contact without strain on connections and terminals.	Tabbing are connected to terminals without any strain.	P
6.3.2	Uninsulated live parts are secured to its supporting surface so that they are prevented from turning or shifting in position.	-	N/A
Supplementary information: N/A			

7	**Connections**		**---**
7.1	**Field connections - general requirements**		**---**
7.1.1	The module is provided with wiring terminals, connectors, or leads to accommodate current-carrying conductors of the load circuit.	Leads are provided	P
7.1.2	Field connections are rated for exposure to direct sunlight as defined in Clause 5 of IS/IEC 61730-1.	Connectors are sunlight resistant.	P
	Field connections are exposed to the degrading effects of direct sunlight.	-	N/A
7.2	**Field wiring terminals**		
7.2.1	Field wiring terminal blocks are rated for the appropriate voltage and current for the application and constructed in compliance with IEC 60947-1.	See Annex 1 for constructional details	P
7.2.2	Wiring terminals integral to the construction of the terminal enclosure comply with the following requirements:	-	N/A
7.2.2.1	Screws and nuts which clamp external conductors have a thread conforming with ISO 261 or ISO 262 (or comparable standards)	See Annex 1 for constructional details	P
	The screws and nuts used for field wiring do not serve to fix any other component.	-	N/A
7.2.2.2	Terminal screws have a minimum nominal thread diameter as shown in Table 2 of IS/IEC 61730-1.	See Annex 1 for constructional details	P
	Stud terminals are provided with nuts and washers.		P

IS/IEC 61730-1:2004 (First Edition) + A1:2017+A2:2017			
Clause	Requirement + Test	Result - Remark	Verdict
7.2.2.3	Terminals are designed that they clamp the conductor between metal surfaces with sufficient contact pressure and without damage to the conductor.	-	N/A
	Terminals are designed or located that the conductor cannot slip out when the clamping screws or nuts are tightened.	-	N/A
	Terminals are fixed suitably when the means of clamping the conductor is tightened or loosened:	-	N/A
	a) the terminal itself does not work loose,	-	N/A
	b) internal wiring is not subjected to stress,	-	N/A
	c) creepage distances and clearances are not reduced below the values specified in clause 9 of IS/IEC 61730-1.	-	N/A
7.3	**Connectors**		
7.3.1	The connector intended for use in the output circuit of the module is rated for the appropriate voltage and current, as per the requirements of the IEC 61984 series.	See Annex 1 for constructional details	P
	Connectors comply with the requirements of Clause 5 of IS/IEC 61730-1, with respect to flammability, comparative tracking index and relative thermal endurance index for the support of live parts.		P
7.3.2	The connector has been appropriately evaluated for disconnect overload performance.	Connector is suitable for assembly only. Marking according to clause 11.3 “Do not disconnect under load” has been provided.	P
7.3.3	Connectors intended for exposure to the outdoor environment are enclosed by material which complies with the following:		---
	a) UV resistance in accordance with the requirements of Clause 5.		P
	b) Resistance to inclusion of water acc. to IEC 60529 (equivalent to IP55)	IP68, as per IEC 62852	P
	c) Steel ball impact test acc. to IEC 60065, subclause 12.1.3 and Figure 8 with a vertical drop distance of 1 m.	Connector is already tested, and IEC test certificate is attached in annex 3	P
	d) Accessibility Test MST 11 of IS/IEC 61730-2	Refer to Accessibility Test table MST-11 results	P
7.3.4	Separable multi-pole connectors are polarised.		N/A

IS/IEC 61730-1:2004 (First Edition) + A1:2017+A2:2017			
Clause	Requirement + Test	Result - Remark	Verdict
	If two or more separable connectors are provided, they are configured or arranged so that the other will not accept the mating connector for one.	--	N/A
7.3.5	For a connector incorporating a grounding member, the grounding member is the first to make and the last to break contact with the mating connector.	-	N/A
7.3.6	Connectors that can be separated without the use of a tool do not have accessible conductive parts, as determined under the Accessibility Test MST 11 of IS/IEC 61730-2.	Refer to Accessibility Test table MST-11 results	P
7.4	**Output lead or cables**		
	Leads extending from the module are rated for the appropriate system voltage, ampacity, wet locations, temperature and sunlight resistance.	The output cables are rated, 1×4mm^2 sizes. -40°C-+90°C, wet or dry sunlight resistant.	P
Supplementary information: N/A			

8	**Bonding And Grounding**		**----**
8.1	If accessible conductive parts of the module form a perimeter framing or mounting system, or if the module has a conductive surface area of greater than 10 cm² accessible after installation, then the module has provisions for grounding.	Pre drilled grounding holes provided, with grounding symbol	P
8.2	If the module is rated as safety class II and provided with provisions for functional grounding, the functional grounding is isolated from live parts by reinforced insulation (Subclause 7.3.2.2 of IEC 61140).	Application Class A, provides safety class II acc. to sec. 3.2	P
8.3	Each exposed conductive part of the module, that is assessable during normal operation, is bonded together, as verified by Ground Continuity Test MST 13 of IS/IEC 61730-2. *Note: If conductive materials are used only as fasteners for installation and separated from the conductive components of the module by both appropriate insulation and spacings, they are not required to be bonded.*	Complete Aluminium frame	P
8.4	Routine maintenance of the module does not involve breaking or disturbing the bonding path.	-	P
	A bolt, screw, or other part used for bonding purposes is not intended for securing the complete device.	Separate holes for grounding and mounting provided	P

IS/IEC 61730-1:2004 (First Edition) + A1:2017+A2:2017			
Clause	Requirement + Test	Result - Remark	Verdict
8.5	Bonding is by a positive means, such as clamping, riveting, bolted or screwed connections, or welding, soldering or brazing.	-	P
	The bonding connection penetrates all nonconductive coatings, such as paint, anodised coatings or vitreous enamel.	-	P
8.6	All joints in the bonding path are mechanically secure.	Frame and corner pieces are crimped together	P
8.7	If the bonding connection depends upon screw threads, two or more screws or two full threads of a single screw engage the metal.	-	P
8.8	The diameter of the grounding screw or bolt is sized appropriately to the gauge of the bonding conductor, as per Table 2 of IS/IEC 61730-1.	See Annex 1 for constructional details	P
8.9	Ferrous metal parts in the grounding path are protected against corrosion by metallic or non-metallic coatings.	No ferrous material used	P
8.10	The module has metal-to-metal multiple-bearing pin-type hinges. These are considered to be an acceptable means for bonding.	-	N/A
8.11	A wiring terminal or bonding location is identified with the appropriate symbol (IEC 60417-5019) or has a green-coloured part.	-	N/A
	No other terminal or location is identified in this manner.	-	N/A
8.12	If a marking is used to identify an equipment grounding terminal, it is located on or adjacent to the terminal, or on a wiring diagram affixed to the module or panel near the terminal.	-	N/A
Supplementary information: N/A			

9	**Creepage and clearance distances**		
9.1	Creepage and clearance distances between uninsulated live parts not of the same potential and between a live part and an accessible metal part, are not less than the values specified in Tables 3 and 4 of IS/IEC 61730-1.	Creepage of minimum 11 mm is required for a system voltage of 1500 vdc	P
	Minimum measured creepage and clearance distances between field wiring terminals (mm) .....:	N/A	-
	Minimum measured clearance distances between internal current carrying parts and accessible points (mm).....:	Minimum measured clearance:13.2 mm	P

IS/IEC 61730-1:2004 (First Edition) + A1:2017+A2:2017			
Clause	Requirement + Test	Result - Remark	Verdict
9.2	Creepage and clearance distances at field wiring terminals have been judged on module open-circuit voltage (Voc).: .....:	-	P
	If additional unmarked terminals exist in the terminal block, or if wiring terminals are marked specifically for grounding, the creepage and clearance distances have been judged on the basis of the maximum system operating voltage.	-	P
9.3	The spacings at a field-wiring terminal have been measured with and without wire connected to the terminal.	-	P
	If the terminal will properly accommodate it, and if the product was not marked to restrict its use, the wire is one size larger than that required, otherwise, the wire is of the required size.	-	P
9.4	Surfaces separated by a gap of 0.4 mm or less have been considered to be in contact with each other.	-	P
Supplementary information: N/A			

10	**Field Wiring Compartments With Covers**		**---**
10.1	**General**		**---**
	If the module is designed for the application of a permanently attached wiring system by an installer in the field, it is to be provided with an enclosed wiring compartment.	-	N/A
10.2	**Wall thickness**		**---**
	If the wiring compartment is intended for the attachment of a field-applied permanent wiring system, the minimum wall thickness for the material complies with Table 5 of IS/IEC 61730-1.	See Annex 1 for constructional details	N/A
10.3	**Internal volume**		**---**
	The internal volume for each intended conductor complies with the requirements of Table 6 of IS/IEC 61730-1.	See Annex 1 for constructional details	N/A
	In the space comprising the minimum required volume, no enclosure dimension is less than 20 mm.		N/A
10.4	**Openings**		
	All openings are provided with appropriate coverings, whose functions comply with the requirements of:		—
	Subclause 5.2.1 of IS/IEC 61730-1		N/A

IS/IEC 61730-1:2004 (First Edition) + A1:2017+A2:2017			
Clause	Requirement + Test	Result - Remark	Verdict
	Wet leakage Current test of Subclause 10.20 of IS 16077:2013/IEC 61646:2008 or 10.17 of IS 14286 (2010).	Refer IS 14286 10.17 test result	P
	Accessibility test MST 11 of IS/IEC 61730-2	Refer IS/IEC 61730-2 MST 11 test result	P
	Coverings can only be removed by the use of a tool		P
10.5	**Gaskets and seals**		**---**
	Gaskets and seals do not deteriorate beyond limits during accelerated ageing, and are not used where they may be subject to flexing during normal operation.		N/A
10.6	**Strain relief**		**---**
	Any strain relief is provided so that stress on a lead intended for field connection, or otherwise likely to be handled in the field, including a flexible cord, is not transmitted to the electrical connection inside the module. *Note: Mechanical securement means which comply with Subclause 10.14 (Robustness of Terminations Test) of IS 14286 (2010) meet this requirement.*	Refer IS/IEC 61730-2 MST 42 test result	P
10.7	**Sharp edges**		**---**
10.7.1	The enclosure is smooth and free from sharp edges, burrs, or the like that may damage insulation or conductors.		P
10.7.2	The inner edges of conduit openings and knockouts are smooth and free from sharp edges, burrs, or the like that may damage insulation or conductors.		N/A
10.8	**Conduit applications - Metallic**		**----**
10.8.1	Any threaded hole in a metal wiring compartment intended for the connection of rigid metal conduit is reinforced to provide metal not less than 6,4 mm thick.		N/A
	Any threaded hole is tapered unless a conduit end stop is provided.		N/A
10.8.2	If threads for the connection of conduit are tapped all the way through a hole in a compartment wall, there are not less than 3.5 nor more than 5 threads in the metal and the construction. was such that a conduit bushing can be attached as intended.		N/A
	The construction is such that a conduit bushing can be attached as intended.		N/A

IS/IEC 61730-1:2004 (First Edition) + A1:2017+A2:2017			
Clause	Requirement + Test	Result - Remark	Verdict
10.8.3	If threads for the connection of conduit are not tapped all the way through a hole in a compartment wall, there are not less than 5 full threads in the metal. and there was a smooth, rounded inlet hole for the conductors.		N/A
	There are smooth, rounded inlet holes for the conductors.		N/A
10.8.4	For a non-threaded opening in a metal wiring compartment intended to accommodate rigid metallic conduit, a flat surface of sufficient area is provided around the opening to accept the bearing surfaces of the bushing and lock washer.		N/A
10.8.5	Conduit complies with the Conduit bending test MST 33 of IS/IEC 61730-2.		N/A
10.9	**Conduit applications - Non-metallic**		**---**
10.9.1	The thickness of sides, end walls, and bottom of a non-metallic wiring enclosure specified for conduit applications is not less than the values specified in Table 7 of IS/IEC 61730-1.		N/A
10.9.2	A non-metallic wiring compartment intended to accommodate non-metallic conduit fulfils the following requirements:		—
	a) It has one or more unthreaded conduit-connection sockets;		N/A
	b) It has one or more threaded or unthreaded openings for a conduit-connection socket, or one or more knockouts that comply with the requirements of Knockout Test MST 44 of IS/IEC 61730-2;		N/A
	c) It complies with the Conduit Bending Test MST 33 of IS/IEC 61730-2, if intended for rigid non-metallic conduit.		N/A
10.9.3	Sockets for the connection of non-metallic conduit provide a positive end stop for the conduit.		N/A
	The socket diameters, the throat diameter at the entrance to the box, the socket depths, and the wall thickness of the socket are within the limits specified in the applicable conduit system.		N/A
10.9.4	A knockout or opening in a non-metallic wiring compartment intended to accommodate rigid non-metallic conduit complies with the dimensional requirements of the applicable conduit system.		N/A
Supplementary information: N/A			

IS/IEC 61730-1:2004 (First Edition) + A1:2017+A2:2017			
Clause	Requirement + Test	Result - Remark	Verdict
11	**Marking**		**P**
11.1	The module includes the following clear and indelible markings:		—
	Name, monogram or symbol of manufacturer	VISAKA INDUSTRIES LIMITED (ATUM DIVISION)	P
	Type or model number	VIL-375M Provided in inside laminate in front side of the module and on backside marking plate	P
	Serial number	VIL120212961017 Provided in inside laminate in front side of the module marking plate.	P
	Polarity of terminals or leads	“+” and "-" provided on connector & Junction Box	P
	Maximum system voltage	1500V	P
	Safety class (IEC 61140)	Provided	P
	The date and place of manufacture are marked on the module or are traceable from the serial number.	Provided. The Date of manufacturing are traceable through serial number provided in inside laminate marking plate. VIL120212961017 VIL1-VISAKA INDUSTRIES LTD (ATUM DIVISION) Line 1 2021-Year of Manufacture 29-Week of the Year 6-Day of the Weak Place and year of manufacturing is mentioned in inside laminate marking plate and also in back label.	P
11.2	The following additional markings are applied to either the module or placed into the instruction and installation data (required documents).		P
	Voltage at open circuit	Provided	P
	Current at short-circuit	Provided	P
	Maximum over-current protection rating, as verified by the Reverse Current Overload Test MST 26 of IS/IEC 61730-2	Provided	P

IS/IEC 61730-1:2004 (First Edition) + A1:2017+A2:2017			
Clause	Requirement + Test	Result - Remark	Verdict
	Recommended maximum series/parallel module configurations	see installation manual	P
	Application class	"A" provided	P
	All electrical data are given relative to Standard Test Conditions (1000 W/m2 @ 25 °C)	Provided	P
11.3	Connectors suitable only for field assembly of modules are marked “Do not disconnect under load”.	Provided	P
11.4	For modules with open-circuit voltage in excess of 50 V, and/or modules rated for maximum system voltage in excess of 50 V, a highly visible warning label regarding the shock hazard is applied near the means of connection to the module.	Max. open circuit voltage 49.39 V @ STC	P
Supplementary information: N/A			

12	**Requirements for supplied documents**		**---**
12.1	The module or panel is supplied with installation instructions describing the methods of electrical and mechanical installation and the electrical ratings of the module.	Provided	P
	The instructions state the application class under which the module was qualified, and any specific limitations required for that application class.	Provided	P
12.2	When the fire rating is dependent on a specific mounting structure, specific spacing, or specific means of attachment to the roof or structure, details of the specific parameter or parameters are included in the instructions.	Provided	P
12.3	The electrical installation instructions include a detailed description of the wiring method.	Provided	P
	The description of the wiring method includes the following information:		—
	Grounding method	Provided	P
	Size, type, and temperature rating of the conductors	Provided	P
	Recommended maximum series/parallel module configurations	Provided	P
	Type of over-current protection and diode bypassing to be used	Fuse rating 14 A provided, Diode - 30SQ 045T provided with the module	P
	Minimum cable diameters when the wiring method is cable	Cable - 62930 IEC 131 provided with the module	N/A

IS/IEC 61730-1:2004 (First Edition) + A1:2017+A2:2017			
Clause	Requirement + Test	Result - Remark	Verdict
	Any limitations on wiring methods that apply to the wiring compartment or box	Cables are not interchangeable	N/A
12.4	The mechanical installation instructions for roof mounting include:		—
	A statement indicating the minimum mechanical means for securing the module or panel to the roof	Provided	---
	A statement that the assembly is to be mounted over a fire resistant roof covering rated for the application (only for non-integral modules or panels)	provided	P
	Indication of any slope required for maintaining a fire class rating	No Slope Required	P
12.5	The installation instructions include a statement advising that artificially concentrated sunlight shall not be directed on the module or panel.	Provided	P
12.6	Assembly instructions are provided with a product shipped in subassemblies and are detailed and adequate to the degree required to facilitate total assembly of the product.	No subassemblies	N/A
12.7	The installation instructions include the proposed statement given in this Subclause (or equivalent) to allow for increased output of the module resulting from certain conditions of use.	Provided	P
Supplementary information: N/A			

ANNEX 1: CONSTRUCTIONAL DETAILS

A1.1	**MODULE TYPE/S**	
	Representative Model: VIL-375M Series Model: VIL-370M	
A1.2	**MODULE DESIGN –DIMENSIONS**	
	Module dimensions (L x W x H) [mm]:	1981x991x35

A1.3	**SOLAR CELL**	
	Cell type reference .....:	Mono-crystalline PERC Manufactured by: ADANI SOLAR CELLS (Mundra Solar Pvt Ltd) Type: MSPVLM2M5
	Cell dimensions L x W (± %) [mm]:	156.75 mm x 156.75 mm ± 0.25 mm
	Cell thickness [µm]:	190 µm ± 30 µm
	Cell area [cm²]:	245.70

A1.4	**IDENTIFICATION OF MATERIALS**	
	Front cover .....:	Manufactured by: Borosil Renewables Limited, Type: AR Coated (Low-iron) Textured Tempered Solar Glass. Thickness: 3.2mm
	Rear cover .....:	Manufactured by: Renewsys India Private Limited, Type: Preserv 1 300 WD, Thickness: 0.395mm, Color: WT, RTI: 140, Flame Spread Index: 30, Partial Discharge: 4.17kV
	Encapsulation material.....:	Manufactured by: Renewsys India Private Limited, Type: CONSERV P 360-14FC, Thickness: 0.45- 0.5mm, HWI=4, HAI=0, RTI:50, Color : NC
	Frame parts.....:	Manufactured by: Saty Satya Surya Aluminium Industries Ltd. Type 6063–T6
	Mounting parts .....:	Modules must be mounted using the mounting holes located on the rear side of the long frame parts using M8 stainless steel bolts, nuts, and washers
	Adhesive for frame .....:	Manufactured by: Sika India Pvt Ltd, Type: Sikasil AS 60 IN, Thickness: 1.5 mm min, Flame Class: HB, HWI: 3, HAI:0, RTI:105, color: WT
	Cell connector .....:	Manufactured by: NEOCAB-PV, AB Industries Type: Cross section: 0.9X0.20 mm, Material: Base Cu ≥ 99.95%, Coating Sn60%Pb40%,
	String connector.....:	Manufactured by: NEOCAB-PV, AB Industries Type: Cross section: 0.3X5.0 mm, Material: Base Cu ≥ 99.95%,Coating Sn60%Pb40%,
	Soldering material .....:	Manufactured by: Kester Type, 245 Flux cored wire Kester
	Fluxing agent .....:	Manufactured by: KESTER, Type: 952S

	Junction box.....:	Manufactured by: Ningbo GZX Photovoltaic Technology Co., Ltd, Type: PV-GZX156V, 1500Vdc, 14A, Reverse Current 30A, -40°C to 85°C, IP65/68.
	Cable.....:	Manufactured by: Ningbo GZX Photovoltaic Technology Co., Ltd, Type: 62930 IEC 131, 1500Vdc, -40°C to 90°C, 120°C
	Connector .....:	Manufactured by: Ningbo GZX Photovoltaic Technology Co., Ltd Type: PV- GZX 1500, 1500VDC, 30A, IP68.
	Bypass diode .....:	Manufactured by: Ningbo GZX Photvoltaic Technology Co. Ltd Type: 30SQ 045T, 45V, 30A
	Potting material .....:	Manufactured by: Shanghai Huitian new material Co., Ltd Type: 5299W-S, Thickness: 3.0 mm min, Flame Class: V-0, HWI: 1, HAI:0, RTI:105, IPT:2.5kV color: WT
	Adhesive for junction box .....:	Manufactured by: Sika India Pvt Ltd, Type: Sikasil AS 60 IN, Thickness: 1.5 mm min, Flame Class: HB, HWI: 3, HAI:0, RTI:105, color: WT
	Additional material (e. g. fixing tape, insulation tape).....:	Aluminium corner Key: Manufactured by: Satya Surya Aluminium Industries Ltd., Type D-6606, Back Label: Speckgrap India Pvt. Ltd, Type: 2M MAT CH PET TC/S-730 Internal Label: Speckgrap India Pvt. Ltd. Type: PET WHITE TC 50 -RC18.

A1.5	**MODULE DESIGN - MINIMUM DISTANCES**	
	Between cells (mm) .....:	2.14
	Between cell and edge of laminate (mm) .....:	13.2
	Between any current carrying part and edge of laminate (mm).....:	18.95

A1.6	**MODULE DESIGN - ELECTRICAL CONFIGURATION**	
	Total number of cells .:	72
	Serial-parallel connection of cells .....:	All cells are in series connection
	Cells per bypass diode:	24
	No. of bypass diodes .:	03

Annex 2: List of measurement equipment

Description	Identification	Application
Measuring Tool, Caliper, Digital or Analog	69881	Creepage Measuring
Magnifying Lens, Without Ruler	76645	Creepage Measuring
Datalogger, RH & Temperature	68611	Creepage Measuring
Meter and/or Sensor, Light	180089	Visual Inspection
Fixture, For Testing, Table	160912	Visual Inspection
Magnifying Lens, Without Ruler	76645	Visual Inspection

Annex 3: Enclosures

Type	Supplement ID	Description
Figure	1-01	Front view of PV Module (VIL-375M)
Figure	1-02	Rear view of PV Module (VIL-375M)
Figure	1-03	PV Module Junction Box – Close and open view Manufactured by: Ningbo GZX Photovoltaic Technology Co., Ltd, Type: PV-GZX156V, 1500Vdc, 14A, Reverse Current 30A, -40°C to 85°C, IP65/68.
Figure	1-04	PV Module Connectors (Male & Female) Manufactured by: Ningbo GZX Photovoltaic Technology Co., Ltd Type: PV- GZX 1500, 1500VDC, 30A, IP68.
Illustration	2-01	Cell Datasheet Mono-crystalline PERC Manufactured by: ADANI SOLAR Type: MSPVLM2M5
Illustration	2-02	Diode Datasheet: Manufactured by: Ningbo GZX Photvoltaic Technology Co. Ltd Type: 30SQ 045T, 45V, 30A
Illustration	2-03	Frame Diagram for 72 cell - (VIL-375M)
Report/ Certificate	3-01	Junction Box: Manufactured by: Ningbo GZX Photovoltaic Technology Co., Ltd, Type: PV-GZX156V, 1500Vdc, 14A, Reverse Current 30A, -40°C to 85°C, IP65/68.
Report/ Certificate	3-02	Cables: Manufactured by: Ningbo GZX Photovoltaic Technology Co., Ltd, Type: 62930 IEC 131, 1500Vdc, -40°C to 90°C, 120°C
Report/ Certificate	3-03	Connectors: Manufactured by: Ningbo GZX Photovoltaic Technology Co., Ltd Type: PV- GZX 1500, 1500VDC, 30A, IP68.
Report/ Certificate	3-04	Sealant: Manufactured by: Sika India Pvt Ltd, Type: Sikasil AS 60 IN, Thickness: 1.5 mm min, Flame Class: HB, HWI: 3, HAI:0, RTI:105, color: WT
Report/ Certificate	3-05	Potting material: Manufactured by: Shanghai Huitian new material Co., Ltd Type: 5299W-S, Thickness: 3.0 mm min, Flame Class: V-0, HWI: 1, HAI:0, RTI:105, color: WT
Report/ Certificate	3-06	EVA: Manufactured by: Renewsys India Private Limited, Type: CONSERV P 360-14FC, Thickness: 0.45- 0.5mm, HWI=4, HAI=0, RTI:50, Color : NC
Report/ Certificate	3-07	Back sheet: Manufactured by: Renewsys India Private Limited, Type: Preserv 1 300 WD, Thickness: 0.395mm, Color: WT, RTI: 140, Flame Spread Index: 30, Partial Discharge: 4.17kV

Manual	4-01	Installation Manual

Figure – 1-01

Figure – 1-02

Figure – 1-03

Figure – 1-04

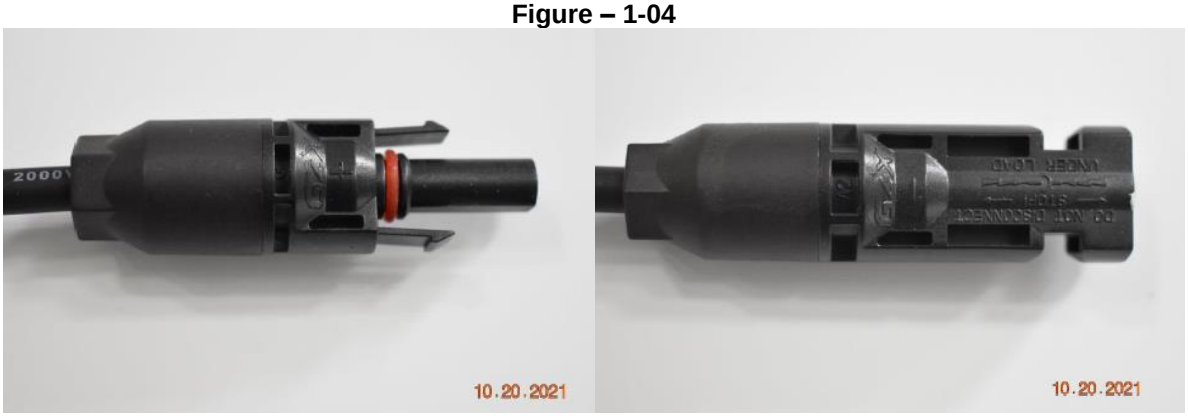


Illustration – 1-01 Mono Crystalline

adani Solar

Mono-crystalline PERC Solar Cell

MSPVLM2M5 19.00-22.50

Features

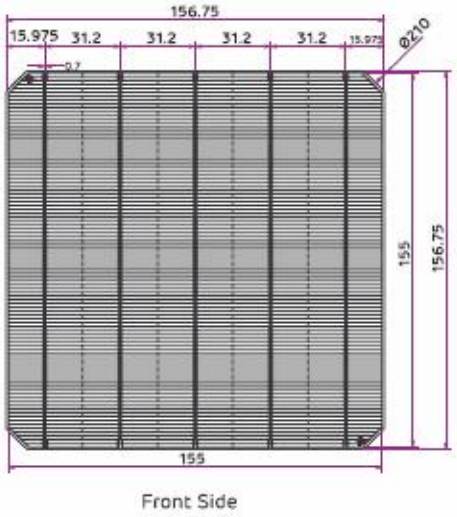
- High-efficiency solar cells with an anisotropically etched surface
- Silicon nitride anti-reflection coating
- Silver front contact bars and dashed surface aluminium back contact field
- Perfect appearance and color uniformity

Performance and Quality

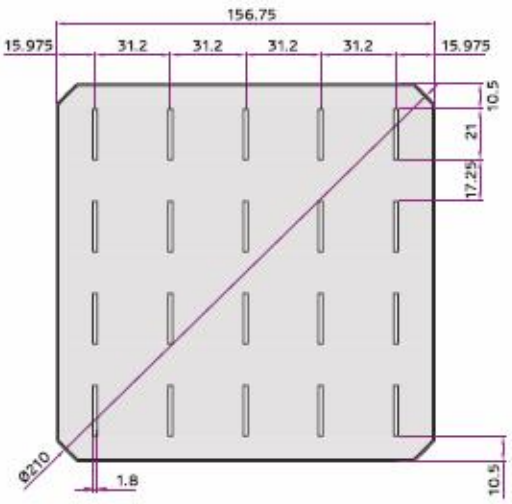
- Proper handling from incoming inspection through production, outgoing inspection and packaging
- 100% checked for reverse current and visual appearance
- Calibrated against Fraunhofer ISE
- RoHS compliance
- 100% PID resistance
- LID regenerated solar cells to minimize LID loss
- ISO 9001, ISO 14001 and OHSAS 18001 certified by TUV NORD
- Soldering peel strength ≥1.0 N/mm Bus Bar width
- Only positive power tolerance binning

Cell layout

(Dimensions in mm)



Front Side



Back Side

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Technical Data

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Electric Performance

Class	Efficiency Range (%)	Rated Power (Wp)	*Maximum Power Current (A)	*Short Circuit Current (A)	*Maximum Power Voltage (V)	*Open Circuit Voltage (V)
A-195	19.5-19.6	4.76	8.956	9.557	0.532	0.640
A-196	19.6-19.7	4.79	8.985	9.559	0.533	0.641
A-197	19.7-19.8	4.81	8.998	9.566	0.535	0.642
A-198	19.8-19.9	4.84	9.013	9.570	0.537	0.643
A-199	19.9-20.0	4.86	9.024	9.574	0.539	0.644
A-200	20.0-20.1	4.89	9.038	9.575	0.541	0.645
A-201	20.1-20.2	4.91	9.045	9.578	0.543	0.646
A-202	20.2-20.3	4.94	9.052	9.583	0.546	0.647
A-203	20.3-20.4	4.96	9.058	9.586	0.548	0.648
A-204	20.4-20.5	4.98	9.063	9.589	0.550	0.649
A-205	20.5-20.6	5.01	9.072	9.593	0.552	0.650
A-206	20.6-20.7	5.03	9.082	9.596	0.554	0.651
A-207	20.7-20.8	5.06	9.094	9.600	0.556	0.652
A-208	20.8-20.9	5.08	9.112	9.603	0.558	0.653
A-209	20.9-21.0	5.11	9.121	9.606	0.560	0.654
A-210	21.0-21.1	5.13	9.129	9.610	0.562	0.655
A-211	21.1-21.2	5.16	9.142	9.614	0.564	0.656
A-212	21.2-21.3	5.18	9.148	9.617	0.567	0.657
A-213	21.3-21.4	5.20	9.153	9.620	0.569	0.658
A-214	21.4-21.5	5.23	9.167	9.624	0.571	0.659
A-215	21.5-21.6	5.25	9.176	9.627	0.572	0.660

Test condition: 1000 W/m², AM 1.5, 25 °C; Power measuring tolerance: ±1.5% rel

Physical Characteristics

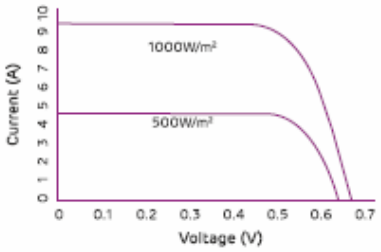
Dimension	156.75 mm x 156.75 mm ± 0.25 mm
Diagonal	210 mm ± 0.5 mm
Thickness (si)	190 µm ± 30 µm
Front Side (-)	Silicon nitride anti-reflection coating 0.7 mm silver Bus Bar
Back Side (-)	Passivated Emitter(SiON and SiNx dual layer) Rear Contact 1.8 mm (silver) discontinuous soldering pads

Temperature Coefficients

Current Temperature Coefficient	0.03 %/K
Voltage Temperature Coefficient	-0.35 %/K
Power Temperature Coefficient	-0.41 %/K

Light Intensity Dependence

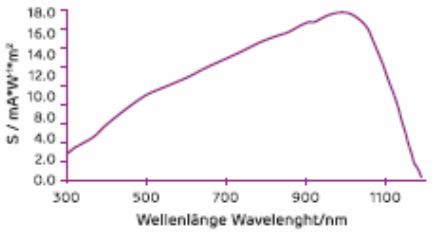
Intensity(W/m2)	Vmpp(%)	Impp(%)
1000	100.0	100.0
900	99.8	90.00
500	98.4	50.00
300	96.2	30.00
200	94.1	20.00



Packaging

Minimize the risk of broken cells with special design

Label with product information



Note:

- The specifications included in this datasheet are subject to change without notice. Adani Solar reserves the right for the final interpretation of all figures reported in this document.

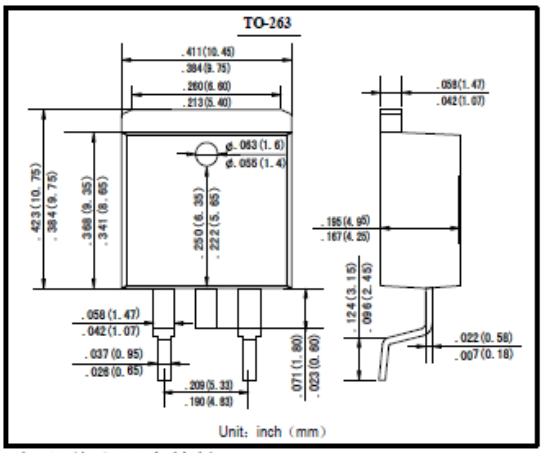
* "Adani Solar" is the brand name for legal entity "Mundra Solar PV Ltd." having its registered office at "Adani Corporate House, Shantigram, S G Highway, Ahmedabad-382 421, Gujarat, India" and manufacturing unit at "Revenue Survey No: 180/P City: Kutch Taluka: Mundra, Village: Tunda, Post office: Bidada; Pin: 370535".

Illustration 2-02

30SQ045T

肖特基二极管
反向电压 45V
正向电流 30A

Schottky Barrier Reifier
Reverse Voltage 45 V
Forward Current 30 A



特征 Features
- 大电流承受能力。High Current Capability
- 正向压降低。Low Forward Voltage Drop
- 低功耗高效率。Low Power Loss，High Efficiency

机械数据 Mechanical Data
- 封装: 塑料封装 Case: Molded Plastic
- 极性: 标记模压或印于本体 Polarity: Symbols molded or marked on body
- 安装位置: 任意 Mounting Position: Any
- 重量: 2.00 克 Weight: 2.00Grams

极限值和温度特性 TA = 25℃ 除非另有规定。
Maximum Ratings & Thermal Charaeristics Ratings at 25℃ ambient temperature unless otherwise specified.

	符号 Symbols	30SQ 045T	单位 Unit
最大可重复峰值反向电压 Maximum repetitive peak reverse voltage	V_{RRM}	45	V
最大均方根电压 Maximum RMS voltage	V_{RMS}	31.5	V
最大直流阻断电压 Maximum DC blocking voltage	V_{DC}	45	V
最大正向平均整流电流 Maximum average forward reified current	$I_{F(AV)}$	30	A
峰值正向浪涌电流 8.3ms单一正弦半波 Peak forward surge current 8.3 ms single half sine-wave	I_{FSM}	250	A
典型热阻 Typical thermal resistance	$R_{\theta Jc}$	1.5	℃/W
工作结温和存储温度 Operating junion and storage temperature range	Tj. TSTG	-55 --- +200	℃

电特性 TA = 25℃ 除非另有规定。
Elerical Charaeristics Ratings at 25℃ ambient temperature unless otherwise specified.

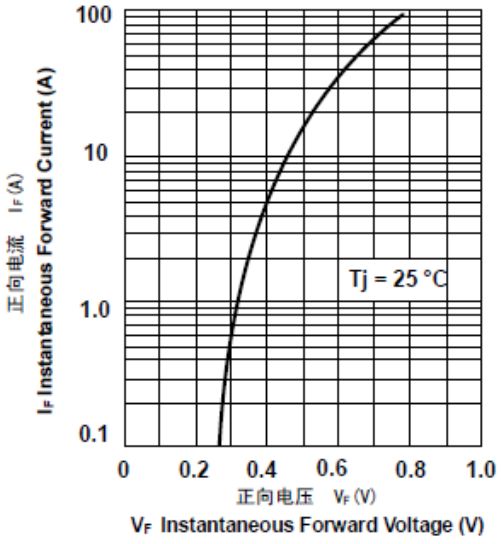
		符号 Symbols	30SQ 045T	单位 Unit
最大正向电压 Maximum forward voltage	I_F = 30A	V_F	0.63	V
最大反向电流 Maximum reverse current	TA= 25℃ TA=100℃	I_R	0.1 15	mA
典型结电容 V_R = 4.0V, f = 1MHz Type junion capacitance		Cj	400	pF

备注： 芯片尺寸：158 mil
NOTE: The chip size is 158 mil.

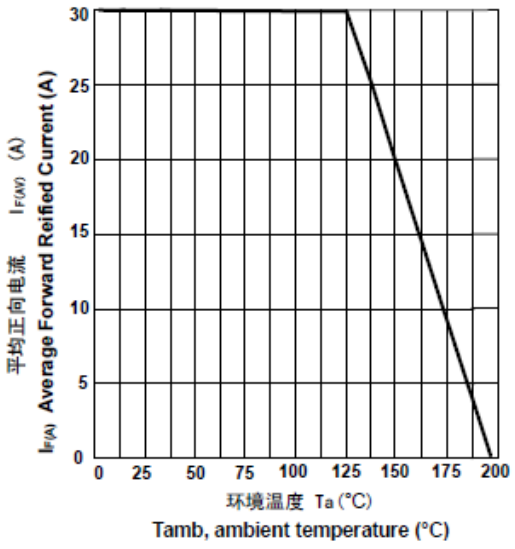
30SQ045T

特性曲线 Charaeristic Curves

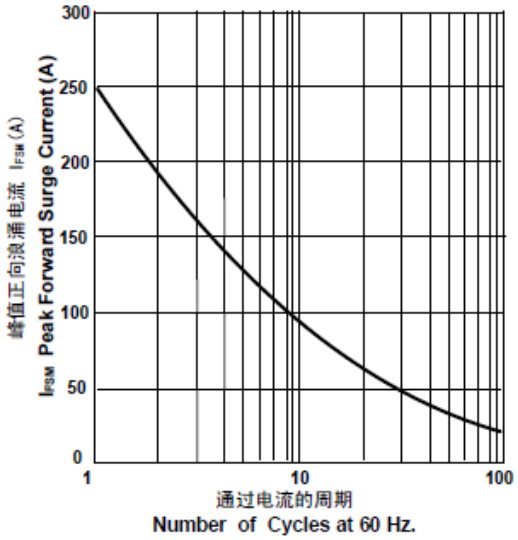
正向特性曲线（典型值）
TYPICAL FORWARD CHARACTERISTIC



正向电流降额曲线
FORWARD CURRENT DERATING CURVE



浪涌特性曲线（最大值）
MAXIMUM NON REPETITIVE
PEAK FORWARD SURGE CURRENT



反向电流特性曲线
MAXIMUM NON REPETITIVE SURGE CURRENT

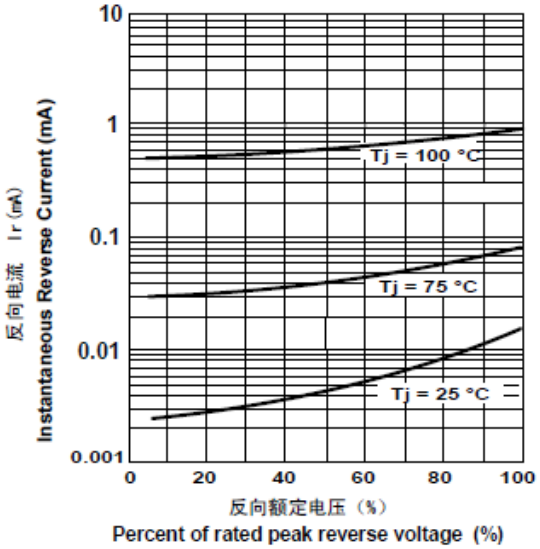
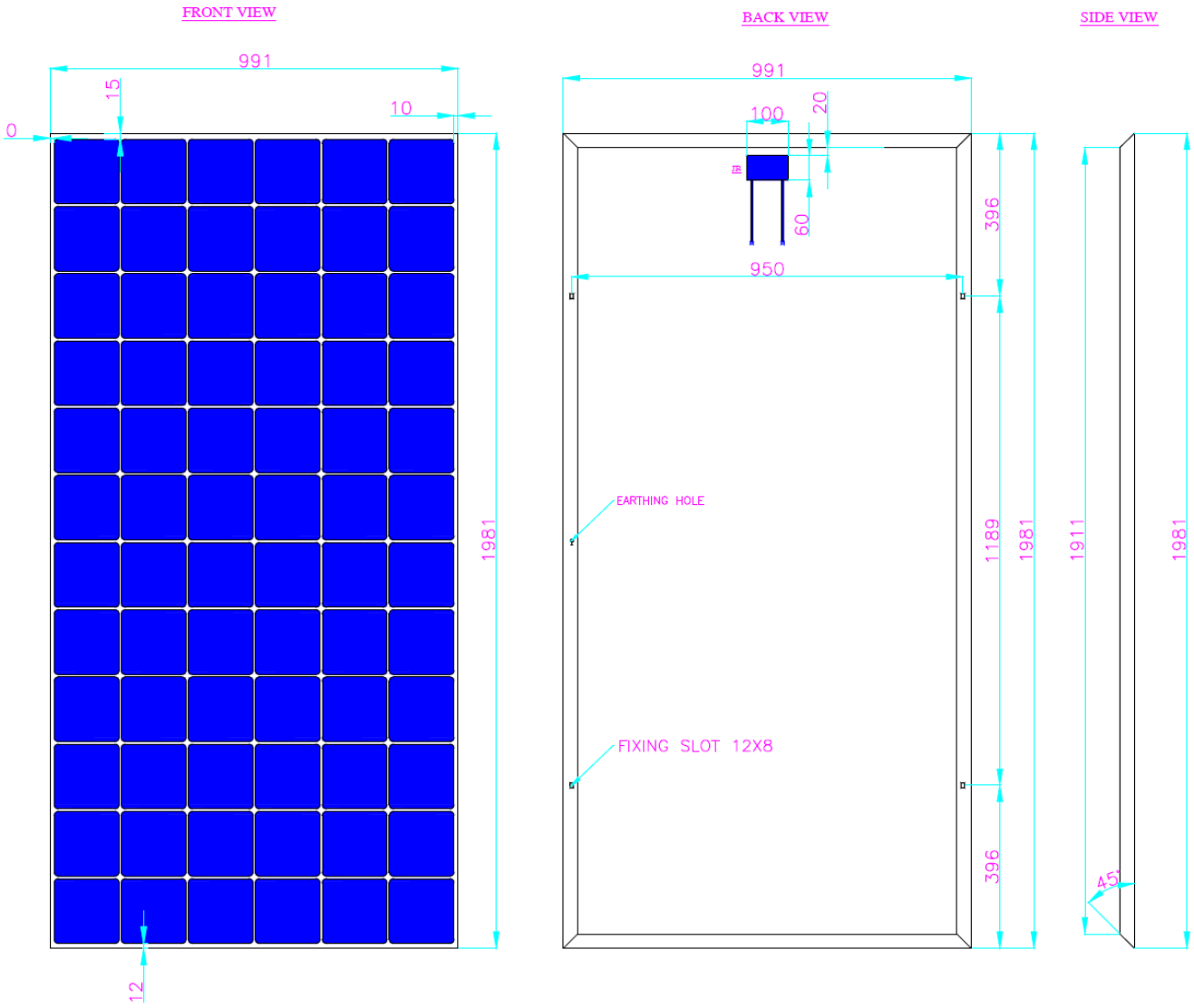
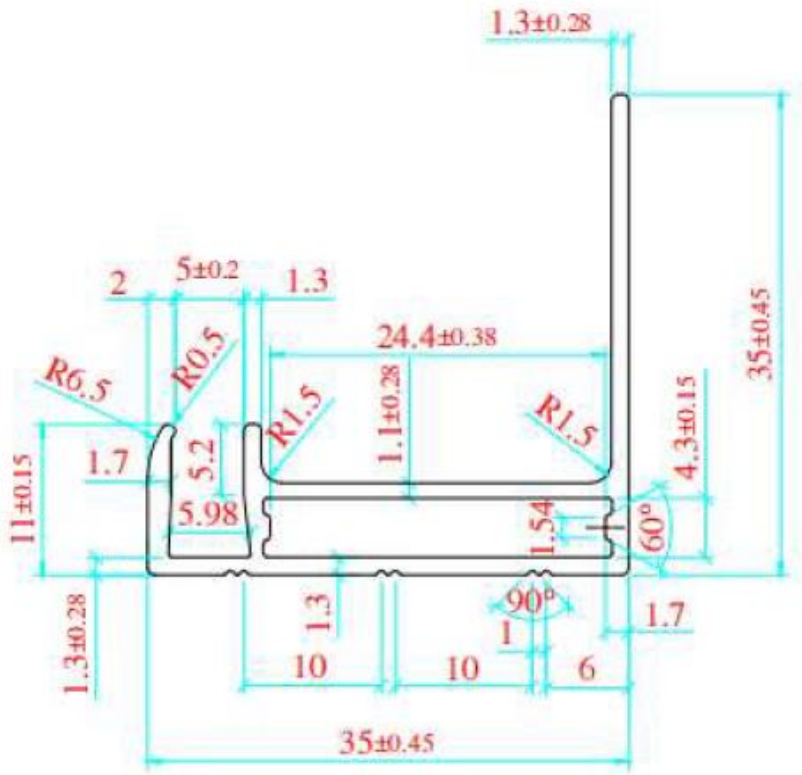


Illustration 2-03



Scale = 1:1



CUSTOMER	CUSTOMER REF.	UNSP.TOLERNACES	PREL.DRG No.
M/s GMKT	DDR No: AC030/ 20-21 DRG No: PDF DRG	AS PER IS:6477	P6007

CUT LENGTH	FLATNESS	STRAIGHTNESS	TWIST	ANGULARITY
3660 ±8 mm	± 0.64 mm	1.70 mm/M	1.70 mm/M	± 2°

AREA Sq.mm	WT/MTR.KG	PERIMETER. mm	CCD.mm	ALLOY/TEMPER	DRN	CHKD	APPD	DATE	SCALE
143	0.386	Out: 167, In 59	49	6063 T6				06-09-20	1:1

SATYA SURYA Aluminium Industries Ltd Shed No. 17, Phase-1, IDA, Cherlapally Hyderabad - 500 051. Ph: 040 - 2726 7944, Fax: 2726 1928 E-mail: info@satyasurya.net Website: www.satyasurya.net	Works: Sy. No: 40, 48, 49 Pamulaparthi road, Gowraram - 502 279 Wargal Mandal, Medak District. Email: malladi@satyasurya.net	Section No. 1488 D-6821	REV. 1	AMD. No

Reports/ certificates 3-01

ZERTIFIKAT ◆ CERTIFICATE ◆ 認證證書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Product Service

CERTIFICATE

No. B 088393 0014 Rev. 01

Holder of Certificate: NINGBO GZX PV TECHNOLOGY CO., LTD
No. 28, Binhai 5th, Road
Hangzhou Bay New District
315336 Ningbo, Zhejiang
PEOPLE'S REPUBLIC OF CHINA

Production Facility(ies): 088393

Certification Mark:

Product: Installation box
Junction Box for PV Module

Model(s): PV-GZX156Q, PV-GZX156Q1, PV-GZX156V, PV-GZX156V1, PV-GZX156H.

Parameters:

Rated Voltage:	1500VDC
Rated Current:	14 A for PV-GZX156V 15 A for PV-GZX156Q and PV-GZX156H 16 A for PV-GZX156Q1 and PVGZX156V1
Reverse Current:	30A
Application Class	A
Protection Class:	II
Degree of Protection:	IP65/IP68(1m,1h) for PV-GZX156Q PV-GZX156Q1; PV-GZX156V PV-GZX156V1; IP65/IP67 for PV-GZX156H
Ambient Temperature:	-40°C ~ +85°C

Tested according to: IEC 62790(ed.1)
EN 62790:2015

The product was tested on a voluntary basis and complies with the essential requirements. The certification mark shown above can be affixed on the product. It is not permitted to alter the certification mark in any way. In addition, the certification holder must not transfer the certificate to third parties. This certificate is valid until the listed date, unless it is cancelled earlier. All applicable requirements of the testing and certification regulations of TÜV SÜD Group have to be complied. For details see: www.tuvsud.com/ps-cert

Test report no.: 704071614002-03
Valid until: 2025-08-06
Date, 2020-08-10

(Yaqun Alex Liu)

Page 1 of 1
TÜV SÜD Product Service GmbH • Certification Body • Ridlerstraße 65 • 80339 Munich • Germany

Reports/certificates 3-02

ZERTIFIKAT ◆ CERTIFICATE ◆ 認證證書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Product Service

CERTIFICATE

No. B 088393 0020 Rev. 00

Holder of Certificate: **NINGBO GZX PV TECHNOLOGY CO., LTD**
No. 28, Binhai 5th, Road
Hangzhou Bay New District
315336 Ningbo, Zhejiang
PEOPLE'S REPUBLIC OF CHINA

Production Facility(ies): 107732

Certification Mark:

Product: **Electric Cables**

Electric cables for photovoltaic systems with a voltage rating of 1,5kV DC

Model(s): 62930 IEC 131 1×1.5mm², 1×2.5mm², 1×4mm²
1×6mm², 1×10mm², 1×16mm², 1×25mm²

Parameters:

Rated Voltage:	DC 1500V (between conductors and between conductor and earth)
Application Class:	A
Protection Class:	II
Ambient Temperature:	-40°C ~+90°C
Max. Temperature at conductor:	120°C

Tested according to: IEC 62930(ed.1)

The product was tested on a voluntary basis and complies with the essential requirements. The certification mark shown above can be affixed on the product. It is not permitted to alter the certification mark in any way. In addition, the certification holder must not transfer the certificate to third parties. This certificate is valid until the listed date, unless it is cancelled earlier. All applicable requirements of the testing and certification regulations of TÜV SÜD Group have to be complied. For details see: www.tuvsud.com/ps-cert

Test report no.: 704072015801-00

Valid until: 2025-07-05
Date, 2020-07-06

(Yaqun Alex Liu)

Page 1 of 1
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Reports/certificates 3-03

TÜV SÜD ◆ CERTIFICAT ◆ 認證證書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICATE ◆ CERTIFICAT

Product Service

CERTIFICATE

No. B 088393 0019 Rev. 01

Holder of Certificate: **NINGBO GZX PV TECHNOLOGY CO., LTD**
No. 28, Binhai 5th, Road
Hangzhou Bay New District
315336 Ningbo, Zhejiang
PEOPLE'S REPUBLIC OF CHINA

Production Facility(ies): 088393

Certification Mark:

Product: **Connector**
Connectors for Photovoltaic Systems

Model(s): **PV-GZX1500, PV-GZX1500A, PV-GZX0601-1**

Parameters:

Rated Voltage:	1500VDC for PV-GZX1500, 1500VDC for PV-GZX1500A, 1000VDC for PV-GZX0601-1
Rated Current:	30A for PV-GZX1500 30A for PV-GZX1500A 30A for PV-GZX0601-1
Application Class:	A
Protection Class:	II
Degree of Protection:	IP68(1m,1h) for PV-GZX1500 IP67 for PV-GZX1500A IP67 for PV-GZX0601-1
Ambient Temperature :	-40°C ~ +85°C

Tested according to: IEC 62852(ed.1)
EN 62852:2015

The product was tested on a voluntary basis and complies with the essential requirements. The certification mark shown above can be affixed on the product. It is not permitted to alter the certification mark in any way. In addition the certification holder must not transfer the certificate to third parties. See also notes overleaf.

Test report no.: 704071614001-02

Valid until: 2024-12-30

Date, 2020-01-17 (Yaqun Alex Liu)

Reports/certificates 3-04

Component - Plastics E504802

Guide Information

Sika India Pvt. Ltd.

B 501 & 502, Lotus Corporate Park, Off. Western Express Highway, Goregaon East, TTC Industrial Area,Turbhe-Indranagar, Mumbai Maharashtra 400063 IN

Sikasil AS 60 IN

Silicone "Room Temperature Vulcanizing" (RTV), furnished as two paste components

Color	Min. Thk (mm)	Flame Class	HWI	HAI	RTI Elec	RTI Imp	RTI Str
WT	1.5	HB	3	0	105	105	105
	3.0	HB	2	0	105	105	105

Comparative Tracking Index (CTI): -
Inclined Plane Tracking (IPT) kV: -
Dielectric Strength (kV/mm): 22
Volume Resistivity (10^X ohm-cm): -
High-Voltage Arc Tracking Rate (HVTR): 0
High Volt, Low Current Arc Resis (D495): -
Dimensional Stability (%): -

ANSI/UL 94 small-scale test data does not pertain to building materials, furnishings and related contents. ANSI/UL 94 small-scale test data is intended solely for determining the flammability of plastic materials used in the components and parts of end-product devices and appliances, where the acceptability of the combination is determined by UL.

Report Date: 2019-03-29
Last Revised: 2019-03-29

IEC and ISO Test Methods

Test Name	Test Method	Units	Thk (mm)	Value
Flammability	IEC 60695-11-10	Class (color)	1.5	HB75 (WT)
			3.0	HB40 (WT)
Glow-Wire Flammability (GWFI)	IEC 60695-2-12	°C	-	-
Glow-Wire Ignition (GWIT)	IEC 60695-2-13	°C	-	-
IEC Comparative Tracking Index	IEC 60112	Volts (Max)	-	-
IEC Ball Pressure	IEC 60695-10-2	°C	-	-
ISO Heat Deflection (1.80 MPa)	ISO 75-2	°C	-	-
ISO Tensile Strength	ISO 527-2	MPa	-	-
ISO Flexural Strength	ISO 178	MPa	-	-
ISO Tensile Impact	ISO 8256	kJ/m^2	-	-
ISO Izod Impact	ISO 180	kJ/m^2	-	-
ISO Charpy Impact	ISO 179-2	kJ/m^2	-	-

Reports/certificates 3-05

iq.ul.com

PROSPECTOR® CLICK TO CONTINUE
View additional material information including performance and processing data

Component - Plastics E248611
Guide Information

Shanghai Huitian New Material Co Ltd
251 Wenji Rd, Songjiang, Shanghai 201616 CN

5299W-S
Silicone "Room Temperature Vulcanizing" (RTV), furnished as two liquid components

Color	Min. Thk (mm)	Flame Class	HWI	HAI	RTI Elec	RTI Imp	RTI Str
WT, BK	3.0	V-0	1	0	105	105	105
	6.0	V-0	0	0	105	105	105
	13.0	V-0	0	0	105	105	105

Comparative Tracking Index (CTI): 0
Dielectric Strength (kV/mm): -
High-Voltage Arc Tracking Rate (HVTR): -
Dimensional Change (%): -
Inclined Plane Tracking (IPT) kV: 2.5
Volume Resistivity (10^x ohm-cm): -
Surface Resistivity (10^x ohms/square): -
High Volt, Low Current Arc Resis (D495): -

ANSI/UL 94 small-scale test data does not pertain to building materials, furnishings and related contents. ANSI/UL 94 small-scale test data is intended solely for determining the flammability of plastic materials used in the components and parts of end-product devices and appliances, where the acceptability of the combination is determined by UL.

Report Date: 2012-05-16
Last Revised: 2015-11-11

IEC and ISO Test Methods

Test Name	Test Method	Units	Thk (mm)	Value
Flammability	IEC 60695-11-10	Class (color)	3.0	V-0 (WT, BK)
			6.0	V-0 (WT, BK)
			13.0	V-0 (WT, BK)
Glow-Wire Flammability (GWFI)	IEC 60695-2-12	°C	-	-
Glow-Wire Ignition (GWIT)	IEC 60695-2-13	°C	-	-
IEC Comparative Tracking Index	IEC 60112	Volts (Max)	-	-
IEC Ball Pressure	IEC 60695-10-2	°C	-	-
ISO Heat Deflection (1.80 MPa)	ISO 75-2	°C	-	-
ISO Tensile Strength	ISO 527-2	MPa	-	-
ISO Flexural Strength	ISO 178	MPa	-	-
ISO Tensile Impact	ISO 8256	kJ/m^2	-	-
ISO Izod Impact	ISO 180	kJ/m^2	-	-
ISO Charpy Impact	ISO 179-1	kJ/m^2	-	-

Reports/certificates 3-06

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Photovoltaic Polymeric Materials E353124

Guide Information

RENEWSYS INDIA PRIVATE LIMITED

Plot No 21, 22 & 23, Bommasandra - Jigani Link Road, Industrial Area, Taluk Anekal, Bangalore Karnataka 562105 IN

CONSERV P 360-14FC

Ethylene Vinyl Acetate (E/VAC), uncured, furnished as sheets

Color	Min. Thk (mm)	Flame Class	HWI	HAI	RTI Elec	RTI Imp	RTI Str
NC	0.45-0.5	-	4	0	50	50	50

Comparative Tracking Index (CTI): 0
Dielectric Strength (kV/mm): -
High-Voltage Arc Tracking Rate (HVTR): -
Dimensional Change (%): -
Inclined Plane Tracking (IPT) kV: -
Volume Resistivity (10^x ohm-cm): -
High Volt, Low Current Arc Resis (D495): -

ANSI/UL 94 small-scale test data does not pertain to building materials, furnishings and related contents. ANSI/UL 94 small-scale test data is intended solely for determining the flammability of plastic materials used in the components and parts of end-product devices and appliances, where the acceptability of the combination is determined by UL.

Report Date: 2014-09-12
Last Revised: 2014-09-12

IEC and ISO Test Methods

Test Name	Test Method	Units	Thk (mm)	Value
Flammability	IEC 60695-11-10	Class (color)	-	-
Glow-Wire Flammability (GWFI)	IEC 60695-2-12	°C	-	-
Glow-Wire Ignition (GWIT)	IEC 60695-2-13	°C	-	-
IEC Partial Discharge	IEC 61730-2, MST 15	Max System Voltage (V)	-	-
IEC Comparative Tracking Index	IEC 60112	Volts (Max)	-	-
IEC Ball Pressure	IEC 60695-10-2	°C	-	-
ISO Heat Deflection (1.80 MPa)	ISO 75-2	°C	-	-
ISO Tensile Strength	ISO 527-2	MPa	-	-
ISO Flexural Strength	ISO 178	MPa	-	-
ISO Tensile Impact	ISO 8256	kJ/m^2	-	-
ISO Izod Impact	ISO 180	kJ/m^2	-	-
ISO Charpy Impact	ISO 179-1	kJ/m^2	-	-

Reports/Certificate 3-07

Letter Report

2018-10-19

Mr. Ashish Kumar Singh
RENEWSYS INDIA PRIVATE LIMITED
Plot No 21, 22 & 23
Bommasandra - Jigani Link Road, Taluk Anekal
Bangalore , Karnataka 562105, India

Reference: Project 4788556277.1.1
Subject: Partial Discharge test of grade PREVERV 1-300WD

Mr. Ashish Kumar Singh

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL.

For the subject project, we have completed the testing at UL India lab . The summary is as follows.

Grade name	Test	Results
PREVERV 1-300WD	Partial Discharge test IEC 61730-2: Ed-1	Measured Extinction voltage (Mean)-4.17kV

Disclaimer

*The results of testing in this report apply only to the sample product/item, which was tested. UL Lab has not participated in the sample selection. This Test report shall not be reproduced except in full without the written approval of the UL Lab. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties. *The applicable standard ambient condition supersedes the lab general ambient conditions.*

Letter Report

2018-09-21

Mr. Ashish Kumar Singh
RENEWSYS INDIA PRIVATE LIMITED
Plot No 21, 22 & 23
Bommasandra - Jigani Link Road, Taluk Anekal
Bangalore , Karnataka 562105, India

Reference: Project 4788556277.1.1
Subject: Radiant Panel test of grade PRESERV 1 300 WD

Mr. Ashish Kumar Singh

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL.

For the subject project, we have completed the testing at UL Northbrook . The summary is as follows.

Grade name	Test	Results
PRESERV 1 300 WD (on Air side)	Radiant Panel test Test as per ASTME162-08	Average Valid Test Flame Index - Rounded to the nearest multiple of five [RP]: 30

Disclaimer

*The results of testing in this report apply only to the sample product/item, which was tested. UL Lab has not participated in the sample selection. This Test report shall not be reproduced except in full without the written approval of the UL Lab. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties. *The applicable standard ambient condition supersedes the lab general ambient conditions.*

RenewSys™
let there be light

Renewsys India Pvt. Ltd.
Division: Bengaluru.
Plot Nos. 21, 22, 23, Bommasandra - Jigani Link Road Industrial Area,Taluk Anekal,
Bengaluru -560105, Karnataka, India.
Tel.: + 91 80 33494545, Fax: + 91 80 33494552. CIN No. U36990MH2011PTC220771
Email: renewsys@renewsysindia.com, Web: www.renewsysworld.com

DATE: 27/07/2018

TO WHOMSOEVER IT MAY CONCERN

Any Single film layer component of a multilayer back sheet meets the UL 1703 par. 7.3 requirements, the composite back sheet which incorporates the film layer is also considered to meet these same requirements.

Based on the highest rated film layer in the respective constructions, the Backsheet RTI (electrical) is 140°C and RTI (strength) is 150°C. The below listed Backsheet's are acceptable for use for PV modules with module operating temperature not to exceed 120° C.

PRESERV 1 150 WD

PRESERV 1 190 WD

PRESERV 1 300 WD

RENEWSYS INDIA PRIVATE LTD. Bangalore

Authorised Signatory.

9/24/2018 UL Certification: E353124 - Photovoltaic Polymeric Materials

iq.ul.com

Photovoltaic Polymeric Materials E353124

Guide Information

RENEWSYS INDIA PRIVATE LIMITED

Plot No 21, 22 & 23, Bommasandra - Jigani Link Road, Industrial Area, Taluk Anekal, Bangalore Karnataka 562105 IN

Preserv 1 300 WD

PVDF/PET/EVAPE, Photovoltaic Backsheets, furnished as sheets

Air-side Color	Cell-side Color	Nom Thk (mm)	Flame Class	HWI	HAI	RTI Elec	RTI Str
WT	WT	0.395	-	-	-	-	-

Comparative Tracking Index (CTI): -
Dielectric Strength (kV/mm): -
High-Voltage Arc Tracking Rate (HVTR): -
Dimensional Stability (%): -
Inclined Plane Tracking (IPT) kV: -
Volume Resistivity (10^x ohm-cm): -
High Volt, Low Current Arc Resis (D495): -

ANSI/UL 94 small-scale test data does not pertain to building materials, furnishings and related contents. ANSI/UL 94 small-scale test data is intended solely for determining the flammability of plastic materials used in the components and parts of end-product devices and appliances, where the acceptability of the combination is determined by UL.

Report Date: 2013-05-31
Last Revised: 2017-09-18

IEC and ISO Test Methods

Test Name	Test Method	Units	Thk (mm)	Value
Flammability	IEC 60695-11-10	Class (color)	-	-
Glow-Wire Flammability (GWFI)	IEC 60695-2-12	°C	-	-
Glow-Wire Ignition (GWIT)	IEC 60695-2-13	°C	-	-
IEC Partial Discharge	IEC 61730-2, MST 15	Max System Voltage (V)	-	-
IEC Comparative Tracking Index	IEC 60112	Volts (Max)	-	-
IEC Ball Pressure	IEC 60695-10-2	°C	-	-
ISO Heat Deflection (1.80 MPa)	ISO 75-2	°C	-	-
ISO Tensile Strength	ISO 527-2	MPa	-	-
ISO Flexural Strength	ISO 178	MPa	-	-
ISO Tensile Impact	ISO 8256	kJ/m^2	-	-
ISO Izod Impact	ISO 180	kJ/m^2	-	-
ISO Charpy Impact	ISO 179-2	kJ/m^2	-	-

Manual 4-01

SAFETY,INSTALLATION,OPERATION&MAINTENANC MANUAL

FOR

SOLAR PHOTOVOLTAIC MODULES

VISAKA INDUSTRIES LIMITED (ATUM DIVISION)
Survey No 95 & 96, Gajalapuram Village, Kukkadam post,Mandal: Madgulapally, Adjacent to Kukkadam Railway station, Nalgonda, Telangana 508207,INDIA.

Document Amendment record

A- Added, M- Modified, D- Deleted

S.No	Date	Revision No	Page No	Change Mode (A/M/D)	Brief description of change
1					
2					
3					
4					
5					
6					
7					
8					

UL India Private Limited
Registered Office: Kalyani Platina - Block I, 3rd Floor
No. 24, EPIP Zone, Phase II, Whitefield, Bangalore - 560066, India
T: 91.80.4138.4400 / F: 91.80.2841.3759 / W: ul.com
CIN: U74200KA1997PTC023189

INTRODUCTION

This manual provides safety, installation, operation and maintenance instructions for VISAKA INDUSTRIES LIMITED (ATUM DIVISION) Mono Crystalline Solar photovoltaic (PV) modules.

It is important to read this manual and understand the instructions carefully, before installation, wiring or using the PV modules. Failure to comply with these instructions will invalidate the VISAKA INDUSTRIES LIMITED (ATUM DIVISION) warranty for Crystalline Solar PV modules. VISAKA INDUSTRIES LIMITED (ATUM DIVISION) reserves the right to make changes to the product specifications, or guide without prior notice.

GENERAL INFORMATION

Solar Photovoltaic Modules consist of a series of electrically interconnected crystalline silicon solar cells. Which are permanently encapsulated between a low iron toughened glass superstrate and substrate. The entire laminate is secured within an anodized aluminum frame for structural strength; ease of installation and to protect the cells from the most severe environmental conditions.

Solar PV modules do not require the use of special cable assemblies. All modules come with a permanently attached junction box that will accept variety applications or with a special cable assembly for ease of installation.

The installation of PV modules requires a great degree of skill and should be performed by qualified and authorized skilled persons. Please be aware that there is a serious risk of various types of injury occurring during the installation including the risk of electric shock. the module is able to operate under environmental condition type Air temperature: -40°C to 85°C Rel. Humidity: < 85% RH

PRODUCT IDENTIFICATION

Each module can be identified by means of the following embedded information:

Rating Label:

It is located on the reverse side of the module. According to UL1703 directives it gives information about the main parameters of the module: Product Type, Maximum Power, Current at Maximum Power, Voltage at Maximum power, Open Circuit Voltage, Short Circuit Current, all as measured under Standard Test Conditions, weight, dimensions, Maximum System Voltage, etc.

Serial No with barcode: Each individual module is identified by a unique serial number accompanied with a barcode.

Below given is typical barcode of a Solar Module:

Format : VIL1 YYYY WW D S BBB

VIL1-VISAKA INDUSTRIES LTD (ATUM DIVISION) Line 1
YYYY-Year of Manufacture
WW-Week of the Year
D-Day of the Weak 1=Mon ……..7=Sun
S-Shift of the Week
BBB -3 B's (BBB) indicate Batch number in the shift

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WARNING

- PV modules produce electricity when sufficient sunlight or other light source illuminates the module. When modules are connected in series, voltage is cumulative. When modules are connected in parallel, current is cumulative. PV systems can produce high voltage and current which could present as increased hazard and may cause serious injury or death. Although touch protection is provided in the form of the fully insulated plug contacts, the following points must be observed when handling the solar modules to avoid the risk of free, arcing and fatal electric shock:
  - The installation of higher voltage systems should be done by qualified, licensed professionals.
  - Cover the entire front surface of the PV modules with a dense, opaque material
  - Do not insert electrically conducting parts into the plugs or sockets.
  - Do not wear metallic jewelry while performing mechanical or electrical Installation.
  - Do not fit solar modules and wiring with wet plugs and sockets! Tools and working conditions must be dry.
  - Be sure to completely ground all modules.
  - Exercise extreme caution when carrying out work on wiring and use the appropriate safety equipment (insulated tools, insulated gloves, etc.)!
  - Do not use damaged modules! Do not dismantle modules! Do not remove any part or label fitted by the manufacturer! Do not treat the rear of the laminate with paint, adhesives or mark it using sharp objects!
- PV modules are heavy. Handle with care.
- Contact with electrically active parts of a PV module such as terminals can result in burns, sparks and lethal shock whether the PV modules connected or not.
- Before you attempt to install, wire, operate and maintain the PV module, please make sure that you completely understand the information described in this installation manual.

Do not connect PV modules directly to motor loads. Variation in PV module output power as a function of solar irradiance may damage directly connected loads.

- The inverter can produce dangerous, high voltages, even when not connected:
  - Exercise extreme caution when working on wiring and the inverter.
  - After switching of the inverter, it is essential to wait for the time interval specified by the manufacturer before beginning any further work.
  - This allows the high voltage components time to discharge.
  - Be sure carefully to follow the inverter manufacturer's installation instructions.
- Modules generate direct current (DC) when any amount of light shines on them. When breaking a connected string of modules (e.g. when disconnecting the DC line from the inverter under load), a lethally strong arc can occur:
  - Never remove the solar generator from the inverter while it is still connected to the main grid!
  - Ensure that the cable connections are in perfect condition (no cracking, soiling or other contamination)!

SAFETY INFORMATION - GENERAL SAFETY

- Ensure that the SPV module is used for its intended purpose only. Pay attention to the local ordinances, building standards and accident- prevention regulations during installation. The safety information for other system components must also be followed.
- Install PV modules and ground frames and other metal component in accordance with applicable codes and regulations
- PV modules should be installed and maintained by qualified personnel. Only installation / service personnel should have access to the PV module installation site.
- Keep children away from PV modules.
- Prior to installation, do not store modules outdoors or in a damp environment to prevent glass from damage due to white efflorescence.
- When PV modules are installed on roofs or any other structures above ground, appropriate safety practices should be followed and appropriate safety equipment should be used in order to avoid possible safety hazards. Note that the installation of PV modules on some roof types may require the addition of fireproofing, as required by local building / fire codes.
- Roof mounted PV modules are to be mounted over a fire resistant roof.
- Only PV modules with the same cell size should be connected in series.
- Follow all safety precautions of other components used in the system.
- In order to avoid risk of injury or electrical shock, do not allow anyone to handle damaged PV modules if the person is unqualified or has limited knowledge of PV modules. Place defective PV modules in cartons so PV cells are completely shaded, because a defective PV module or module with broken glass may generate power even if it is removed from the system.
- Avoid uneven shade on the PV module surface. Shaded cells may become hot and create hot spot, which may result in permanent damage to the module (e.g. solder joints may peel off).
- Do not clean the glass surface with chemicals. Do not let water stay on the glass surfaces of PV modules for a long time. This creates a risk of permanent damage to the glass, such as white efflorescence, otherwise known as “glass disease,” which may cause reduced power output.
- To avoid dirt accumulation or white efflorescence due to water accumulation, do not install PV modules horizontally (flat).
- In high snow load regions, appropriate measures are to be taken so that PV module frames (on lower edges of the modules) will not be damaged.
- Do not expose PV modules to sunlight concentrated with mirrors, lenses or other means.
- Turn off inverters and circuit breakers immediately, should a problem occur.
- The maximum open circuit voltage must not be greater than the specified maximum system voltage. Voltage is proportional to the number of PV modules in series and is affected by weather conditions. For strings connected in parallel take proper measures to block reverse current flow.
- Photovoltaic modules produce DC electricity when exposed to light and therefore can produce an electrical shock or burn. Modules produce voltage even when not connected to an electrical circuit or load. Modules produce nearly full voltage when exposed to as little as 5% of full sunlight and both current and power increase with light intensity. Use insulated tools and rubber gloves when working with modules in sunlight.
- PV modules have no on/off switch. Modules can be rendered inoperative only by removing them

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from sunlight, or by fully covering their front surface with cloth, cardboard, or other completely opaque material, or by working with modules face down on a smooth, flat surface.

- Modules can produce higher output than the rated specifications and the "Rated electrical characteristics are within 10 percent of measured values at Standard Test Conditions of: 1000 W/m^2, 25°C cell temperature & AM 1.5 spectrum as per ASTM E 892" Reflection from snow or water can increase sunlight and therefore boost current and power. In addition, colder temperatures can substantially increase voltage and power.
- VISAKA INDUSTRIES LIMITED (ATUM DIVISION) modules are constructed with tempered glass, but still must be handled with care. If the front glass is broken or if the polymer back-skin is torn, contact with any module surface or the frame can produce electrical shock, particularly when the module is wet. Broken or damaged modules must be disposed of properly.

IMPORATANT HANDLING & SAFETY INSTRUCTIONS

- Do not expose the PV module to excessive loads on the surface of the PV module or twist the frame. The glass may break.
- Do not stand or step on the PV module. The glass may be slippery, and there is a risk of injury or electric shock if glass is broken.
- Do not hit or put excessive load on the glass or back sheet. PV cells may break.
- To avoid damage to the back sheet, do not scratch or hit the back sheet.
- To avoid damage to the terminal box and electricity leakage or shock, do not hit the terminal box; do not pull the interconnect cables; do not scratch the interconnect cable.
- Avoid the connector from scratching or impacting the back sheet of the module.
- Install connector such that it is not exposed to direct sunlight.
- Do not twist the interconnect cable excessively.
- Never touch the end of the interconnect cables with bare hands when the module is illuminated. Cover the surface of module with cloth or other sufficiently opaque material to block the module from incident light and handle the wires with insulated gloved hands to avoid electric shock.
- Do not drill holes in the frame. It may compromise the frame strength and cause corrosion of the frame.
- Do not scratch the anodized coating of the frame (except for grounding connection). It may cause corrosion of the frame or compromise the frame strength.
- Do not loosen or remove the screws from the PV module. It may compromise the strength of the PV module and cause corrosion.
- Do not touch the PV module with bare hands. The frame of the PV module has sharp edges and may cause injury. Wear suitable gloves, such as leather gloves with padding in the palm and finger areas.
- Do not drop the PV module or allow objects to fall on the PV module.
- Do not lift the PV module by only one side. The frame may bend. Always use two hands to lift and carry the PV module on the long side of the frame.
- Do not install or handle the modules when they are wet or during periods of high wind.
- Be familiar with the basic principles of electricity and electrical equipment. Use properly insulated tools and appropriate protective equipment. Obtain and use a voltmeter for all systems where there is more than one module in series.

- **DANGER!** Module interconnection cables pass DC and are sources of voltage when the module is under load and when it is exposed to light. Direct Current can arc across gaps and may cause injury or death if improper connection or disconnection is made, or if contact is made with module leads that are frayed or torn. Do not connect or disconnect modules when current from the modules or an external source is present.

INSTALLATION SAFETY

- Always wear protective head gear, insulating gloves and safety shoes (with rubber soles).
- Keep the PV module packed in the carton until installation.
- Do not touch the PV module unnecessarily during installation. The glass surface and the frame may be hot. There is a risk of burns and electric shock.
- Do not work in rain, snow or windy conditions.
- Due to the risk of electrical shock, do not perform any work if the terminals of the PV module are wet.
- Use insulated tools.
- Do not use wet tools.
- When installing PV modules, do not drop any objects (e.g., PV modules or tools).
- Make sure flammable gasses are not generated or present near the installation site.
- Insert interconnect connectors fully and correctly. Check all connections.
- The interconnect cable should be securely fastened to the module frame, the mounting racking or in a raceway to prevent movement of the interconnect cable over time. Cable support should be done in a way to avoid the connector from scratching or impacting the back sheet of the module.
- Do not touch the terminal box and the end of the interconnect cables (connectors) with bare hands during installation or under sunlight, regardless of whether the PV module is connected to or disconnected from the system.
- Do not unplug a connector if the system circuit is connected to an operating load.
- Do not work alone (always work as a team of 2 or more people).
- Wear a safety harness when working above the ground.
- Do not wear metallic jewelry which may conduct electricity and enable electric shock during installation.
- Do not damage the back sheet of PV modules when fastening the PV modules to a support by bolts.
- Do not damage the surrounding PV modules or mounting structure when replacing a PV module.
- Use UV resistant cable ties or other wire management hardware to secure the interconnect cables. Drooping cables may cause various problems, such as leading to electrical shorts.
- Take proper measures for preventing the laminate (consisting of encapsulate, cells, glass, back sheet, etc.) from dropping out of the frame in case the glass is broken.
- Cables shall be located so that they will not be exposed to direct sunlight in order to prevent degradation of the interconnect cables.

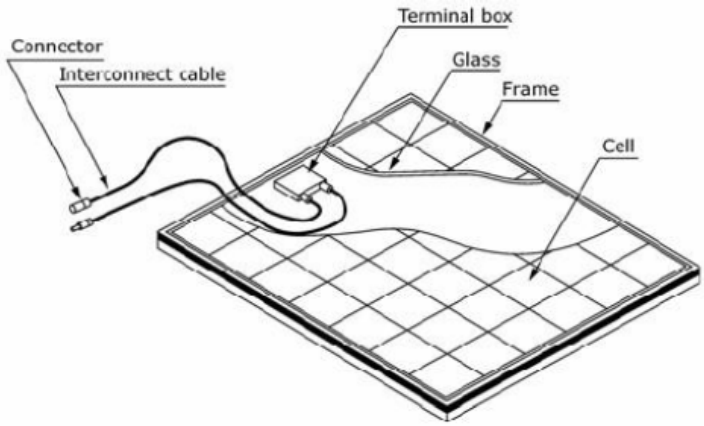

Fig 1: SPV module components

"The fire rating of this module is valid only when mounted in the manner specified in the mechanical mounting instructions."

SITE SELECTION

SPV Modules should be installed in a location where there is no shading throughout the year and they will receive maximum sunlight throughout the year. In the Northern Hemisphere, the Module should typically face south, and in the Southern Hemisphere, the Modules should typically face north. Modules facing 30 degrees away from true South (or North) will lose approximately 10 to 15 per cent of their power output. If the Module faces 60 degrees away from true South (or North), the power loss will be 20 to 30 per cent.

Please make sure that there are no obstructions in the surroundings of the site of installation, which could cast shadows on the solar photovoltaic modules especially during the winter months when the arc of the sun is lowest over the horizon. Shading causes loss of output, even though the factory fitted bypass diodes of the SPV Module will minimize any such loss.

Take proper steps in order to maintain reliability and safety in case the PV modules are installed in areas that have heavy snow / extreme cold / strong winds / installations over, or near, water and areas where installations are prone to salt water exposure or on small islands or in desert areas.

TILT ANGLE SELECTION

The tilt angle of the PV module is measured between the surface of the PV module and a horizontal ground surface. The PV module generates maximum output power when it faces the sun directly.

For standalone systems with batteries where the PV modules are attached to a permanent structure, the tilt angle of the PV modules should be selected to optimize the performance based on seasonal load and sunlight. In general, if the PV output is adequate when irradiance is low (e.g., winter), then the angle chosen should be adequate during the rest of the year.

For grid-connected installations where the PV modules are attached to a permanent structure, PV modules should be tilted so that the energy production from the PV modules will be maximized on an annual basis.

SPV Modules connected in series should be installed at same orientation and angle. Different orientation or angle may cause loss of output power due to difference of amount of sunlight exposed to the Module.

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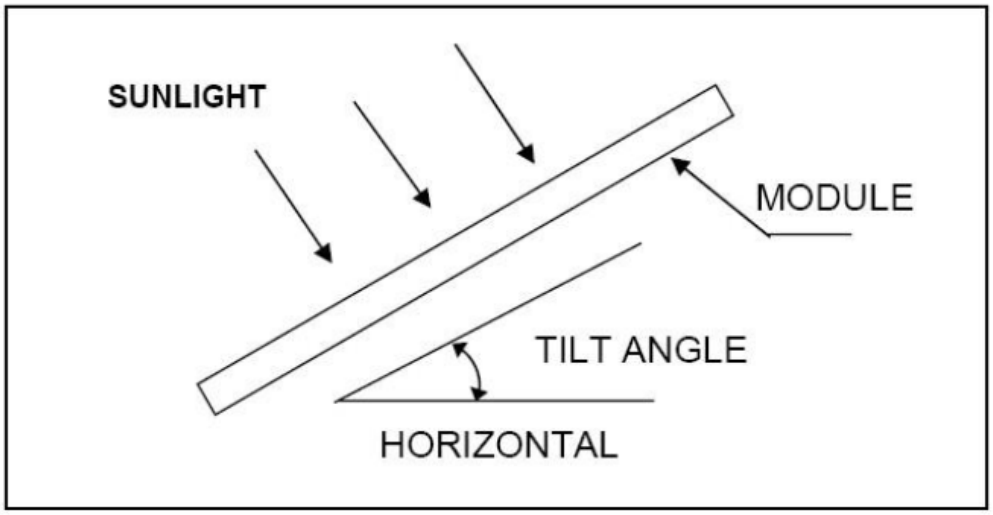

Fig 2: SPV Module Tilt Angle

CODES AND REGULATIONS

The mechanical and electrical installation of PV systems should be performed in accordance with all applicable codes; including electrical codes, building codes, and electric utility interconnect requirements. Such requirements may vary for mounting location, such as building rooftop or motor vehicle applications. Requirements may also vary with system voltage, and for DC or AC application. Contact local authorities for governing regulations. In the U.S., all installations should conform to the National Electrical Code (NEC), ANSI/NFPA 70, including Article 690 on Solar Photovoltaic Systems and all other appropriate articles and sections.

ELECTRICAL INSTALLATION

In the field Wiring System the electrical connection means of module should be marked as:

"+" and "–"or
"POS" and "NEG" or
"POSITIVE" and "NEGATIVE" so as easily visible.

To ensure proper system operation and maintain the warranty, be careful to observe the correct cable connection polarity (Fig 3) when connecting the modules to a battery or to other modules. If not connected correctly, the bypass diode(s) could be destroyed.

Each Module has two #12 AWG type standard 90°C sunlight resistant output cables each terminated with plug & ply connectors. This cable is suitable for applications where wiring is exposed to the direct rays of the Sun. We recommend that all wiring and electrical connections comply with the National Electrical Code (NEC).

For field connections, use the minimum No. #12 AWG copper wires insulated for a minimum of 90°C, rated

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for wet conditions and resistant to ultra violet radiation and Sunlight resistant as well. The minimum and maximum outer cable diameters of the cable are 5 to 7mm. Refer to table1 for the maximum electrical rating of series fuse.

All PV modules must be grounded by electrical connection of the module frames to ground. Care must be taken to arrange the system ground so that the removal of one module from the circuit will not interrupt the grounding of any of the other modules. For grounding, each PV module has a hole in the frame for a bolt, nut and washer, a ground lug fastened by bolt or screw, or an appropriate screw (hardware not provided). Installation for wiring shall be in accordance with the NEC and grounding method shall comply with the NEC, article 250 and the relevant instructions below. In a connection of this type, the hardware (such as a star washer) must score the frame surface to make positive electrical contact with the frame.

Hardware used must be compatible with the mounting structure material to avoid galvanic corrosion.

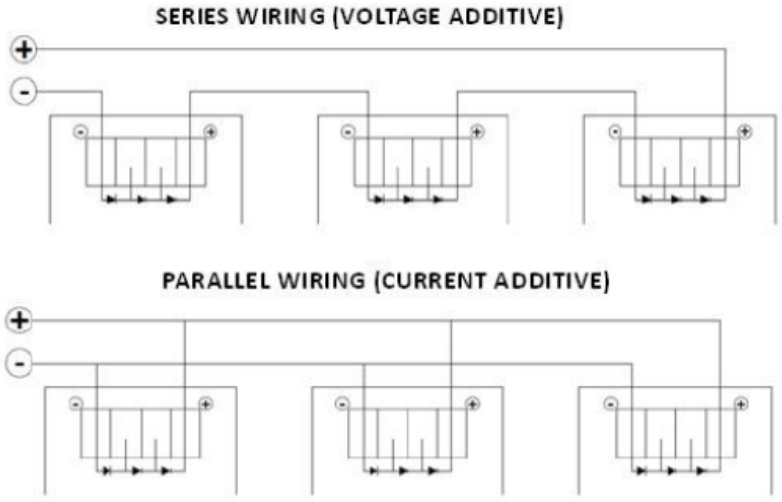

Fig 3 : Module Wiring

PRODUCT SPECIFICATIONS

The module electrical ratings are measured under Standard Test Conditions (STC) of 1KW/m² at cell temperature of 25°C with Air mass of 1.5 spectrums. VISAKA INDUSTRIES LIMITED (ATUM DIVISION)modules deliver specific electrical characteristics as the below table.

- Maximum System Voltage (V)	1500
- Maximum Over Current Protection rating (A)	14
- Maximum fuse rating (A)	14
- Application Class for PV Module	A
- Safety Class of PV Modules in accordance with IEC 61140	II

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- Fire Resistance Class range – Spread of Flame Test	C
- Recommended Maximum Series/Parallel module configuration	24 in series and 1 in parallel.

For Model No. and Electrical Ratings refer the Back Label pasted on the module.
Bypass Diode Type: Schottky Diode
Model no: 30SQ045T
Ratings of diode: Reverse Voltage: 45V, Forward Current: 30A

MECHANICAL INSTALLATION

The Module frame is made of anodized aluminum, and therefore corrosion can occur if the Module is subject to a salt water environment with contact to a rack of another type of metal (Electrolysis Corrosion).
The design load of VISAKA INDUSTRIES LIMITED (ATUM DIVISION) modules is 30 lb/sq ft as per UL standards. If required, stainless steel washers can be placed between the SPV Module frame and support structure to prevent this type of corrosion. Module support structures that are to be used to support SPV Modules at correct tilt angles should be wind and snow load rated for use by the appropriate local and civil codes prior to installation.
"The module is considered to be in compliance with UL 1703 only when the module is mounted in the manner specified by the mounting instructions below."
SPV Modules can be mounted as following method:
- Using corrosion-proof screws (M8) on the existing installing holes in the Module frame

The frame of each Module has 8mm x 12mm mounting holes used to secure the modules to supporting structure. The Module frame must be attached to a supporting structure using M8 stainless steel bolt hardware together with hex nut, spring washers and 2nos of plain washers in four places (i.e. minimum number holes to be used are 4 mounting holes) symmetrical on the SPV Module. The applied torque is about 8 Newton-meters.

The Module clamps must not come into contact with the front glass and must not deform the frame. Avoid shadowing effects from the Module clamps and the insertion systems. It is not permitted to modify the Module frame under any circumstances. Recommended distance between two Solar Modules is 5mm considering linear thermal expansion of the Module frames.
Clearance between the Module frame and mounting surface may be required to prevent the junction box from touching the surface, and to circulate cooling air around the back of the Module.
The Modules are not designed for integral mounting as part of a roof or wall. The mounting design may have an impact on the fire resistance. If the Modules are to be installed on the roof or wall of a building, the fire resistance of roof covering or wall should be rated for the application. Here the standoff method or the rack method is recommended. The Modules are supported parallel to surface of the building wall or roof. Clearance between the Module frames and surface of the wall or roof is required to prevent wiring damage and to allow air to circulate behind the Module. The recommended stand-off height is 115mm. Any slope less than 5in/ft (127mm/305mm) required to maintain a fire class rating. Do not mount SPV Module in such way that the drain holes of SPV Module are intended to block up. The junction box shall be in the uppermost position of slope to minimize the ingress of water.

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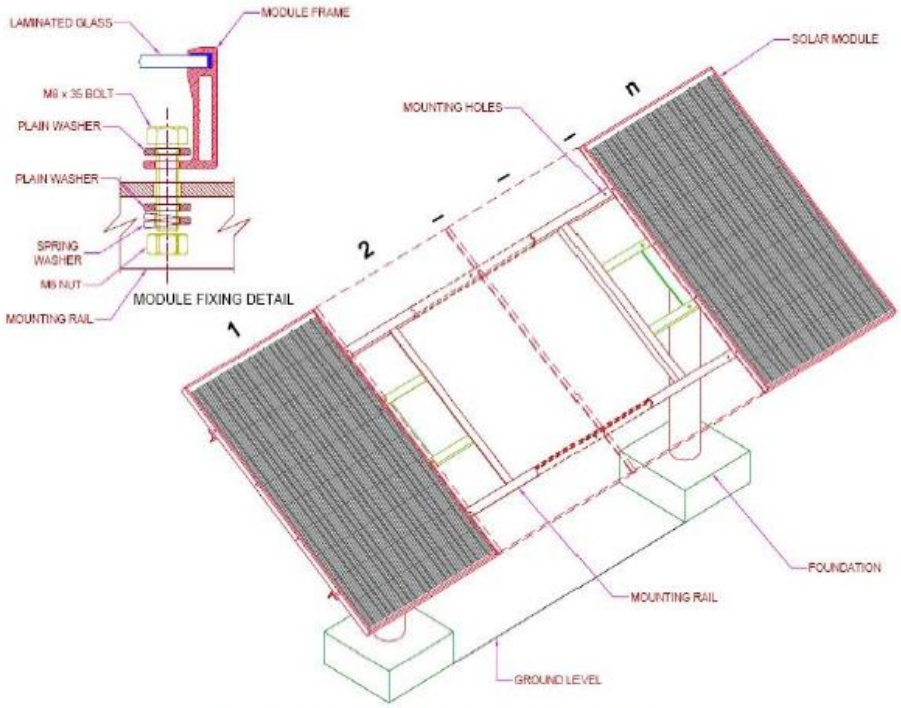

Fig 4: Mechanical Assembly of SPV Modules

GROUNDING

"A module with exposed conductive parts is considered to be in compliance with UL 1703 only when is electrically grounded in accordance with the instructions presented below and the requirements of the National Electrical Code." All Module frames and mounting racks must be properly grounded in accordance with the National Electrical Code NEC. Proper grounding is achieved by connecting the Module frame(s) and structural members contiguously one to another using a suitable grounding conductor. The grounding conductor or strap may be copper, copper alloy, or other material acceptable for use as an electrical conductor per NEC. The grounding conductor must then make a connection to earth using a suitable earth ground electrode.

Attach a separate conductor to one of the 4mm diameter grounding holes marked '  ' on the Module frame with a screw and nut that incorporates an external tooth washer. This is to ensure positive electrical contact with the frame.

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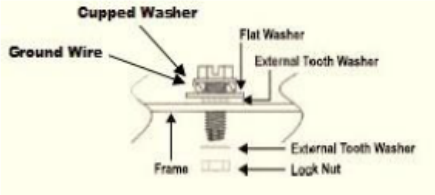
The rack must also be grounded unless they are mechanically connected by nuts and bolts to the grounded SPV Modules. The array frame shall be wired and grounded in accordance with NEC Article250 & CSA C22.1, Safety Standard for Electrical Installations, Canadian Electrical Code, Part 1 .

It is recommended to ground each module frame at the provided grounding holes (4 mm or 5/32 inch diameter, marked with the grounding symbol).

The ground connections between modules must be approved by a qualified electrician. The main earth ground must only be connected by a qualified electrician. UL approved grounding method is mandatory in the USA and Canada. Installation shall be in accordance with CSA C22.1,Safety Standard for Electrical Installations, Canadian Electrical Code, Part I.

The modules can be connected at the grounding holes using stainless steel nut, bolt, start washer and flat washer of size



The grounding screw, bolt or other parts are separately used from the mounting parts of the module. The grounding is achieved through securement to the array frame. The array frame shall be grounded in accordance with NEC Aarticle 250.

e M4. The torque rating provided for grounding means is 2.8 Nm [25 in.–lbs].. The grounding method of the frame of arrays shall comply with the NEC, article 250.

BLOCKING DIODES

Blocking diodes are typically placed between the battery and the PV module output to prevent battery discharge at night. VISAKA INDUSTRIES LIMITED (ATUM DIVISION) modules are made of Mono cells with high electrical "back flow" resistance to nighttime battery discharging. As a result, VISAKA INDUSTRIES LIMITED (ATUM DIVISION) modules do not contain a blocking diode when shipped from the factory. Most PV charge regulators do have blocking diodes with nighttime disconnect feature.

BYPASS DIODES

Partial shading of an individual Module can cause a reverse voltage across the shaded SPV Module. Current is then forced through the shaded area by the other Modules.

When a bypass diode is wired in parallel with the series string, the forced current will flow through the diode

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and bypass the shaded SPV Module, thereby minimizing Module heating and array current losses.
Each module junction box has the bypass diodes installed between two of the terminal screws. Diodes that are used as bypass diodes must: Have a Rated Average Forward Current [IF(AV)] **above** maximum system current at highest module operating temperature.
Have a Rated Repetitive Peak Reverse Voltage [VRRM] **above** maximum system voltage at lowest module operating temperature.

BATTERY

When solar modules are used to charge batteries, the battery must be installed in a manner which will protect the performance of the system and the safety of its users. **Follow the battery manufacturer's guidelines concerning installation, operation and maintenance recommendations**. In general, the battery (or battery bank) should be away from the main flow of people and animal traffic. Select a battery site that is protected from sunlight, rain, snow, debris, and is well ventilated. Most batteries generate hydrogen gas when charging, which can be explosive. Do not light matches or create sparks near the battery bank. When a battery is installed outdoors, it should be placed in an insulated and ventilated battery case specifically designed for the purpose.

MAINTENANCE

VISAKA INDUSTRIES LIMITED (ATUM DIVISION) Modules are designed for long life and require very little maintenance. Visually inspect all modules annually for safe electrical connections, sound mechanical connection, and free from corrosion. This visual inspection should be performed from ground level. Under most weather conditions, normal rainfall is sufficient to keep the SPV Module glass surface clean when the angle of the PV module is 5° or more. If dirt build-up becomes excessive, clean the glass only with a soft cloth using water. If cleaning back of the module is required, take utmost care not to damage the backside materials for smaller power plants. For the bigger power plants clean a module, wash with potable, non-heated water. Normal water pressure is more than adequate, but pressurized water upto 1500psi may be used. Finger prints, stains, or accumulations of dirt on the front surface may be removed as follows. First rinse off area and let soak for a short period of time (5 minutes) re-wet and use a soft sponge or seamless cloth to wipe glass surface in a circular motion. Fingerprints typically can be removed with a soft cloth or sponge and water after wetting. Do not use harsh cleaning materials such as scouring powder, steel wool, scrapers, blades or other sharp instruments to clean the glass surface of the module. Use of such materials or cleaning without consultation will invalidate the product warranty. SPV Modules that are mounted flat (0° tilt angle) should be cleaned more often, as they will not "self clean" as effectively as modules mounted at a 15° tilt or greater. In order to ensure proper operation of the system, the following system be inspected at regular intervals

a) Check all wiring connections are secure, tight, clean and free of corrosion.
b) The condition of the wire insulation periodically. Cables are not damaged in any way.
c) The conductivity of module frame to earth ground.
d) Also, check to be sure that mounting hardware is tight. Loose connections will result in damage for array.
e) Changed SPV Module must be the same kind and type.

DISCLAIMER OF LIABILITY

The installation techniques, handling and use of this product are beyond company control. Therefore, VISAKA INDUSTRIES LIMITED (ATUM DIVISION) does not assume responsibility and express disclaims liability for loss, damage or expense arising out of, or in any way connected with resulting from improper installation, operation, maintenance, handling or use.

Since the use of this Safety, Installation, Operation and Maintenance Manual and the conditions of installation, operation, use and maintenance of the module are beyond VISAKA INDUSTRIES LIMITED (ATUM DIVISION) control, VISAKA INDUSTRIES LIMITED (ATUM DIVISION) does not assume responsibility and expressly disclaims liability for loss, damage, injury or expense arising out of or in any way connected with such installation, operation, use or maintenance of the module. VISAKA INDUSTRIES LIMITED (ATUM DIVISION) assumes no responsibility for any infringement of patents or other rights of third parties that may result from use of the module. No license is granted by implication or otherwise under any patent or patent rights.
The information in this Manual is based on VISAKA INDUSTRIES LIMITED (ATUM DIVISION) knowledge and experience and is believed to be reliable; but such information including product specifications (without limitations) and suggestions do not constitute a warranty, expressed or implied. VISAKA INDUSTRIES LIMITED (ATUM DIVISION) reserves the right to make changes to the product, specifications or this manual without prior notice.

LIMITED WARRANTY

Module limited warranties are described in full in the VISAKA INDUSTRIES LIMITED (ATUM DIVISION) warranty certificates obtainable at VISAKA INDUSTRIES LIMITED (ATUM DIVISION) sales. In summary, the Limited Warranties do not apply to any of the following;

PV modules which in VISAKA INDUSTRIES LIMITED (ATUM DIVISION)'s absolute judgment have been subjected to: misuse, abuse, neglect or accident; alteration, improper installation, application or removal (including but not limited to installation, application or removal by any un authorized party; non-observance of VISAKA INDUSTRIES LIMITED (ATUM DIVISION)'s installation, users and/or maintenance instructions; repair or modifications by someone other than an approved service technician of VISAKA INDUSTRIES LIMITED (ATUM DIVISION); power failure surges, lightning, flood, fire, accidental breakage or other events outside VISAKA INDUSTRIES LIMITED (ATUM DIVISION)'s control.

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Annex: 4 Electrical data table.

PV Module Type Name	Open Circuit Voltage @ STC, (Voc)	Rated Voltage @ STC/Vmp (V dc)	Maximum System Voltage, (V dc)	Rated Current @ STC/Imp (A)	Short Circuit Current @ STC/Isc (A)	Rated Maximum Power at STC, (Watts)	Maximum Series Fuse, (A)
72 cell series (Monocrystalline)							
VIL-370M	49.36	40.70	1500	9.11	9.68	370	14

---------End of TRF IS/IEC 61730-1--------